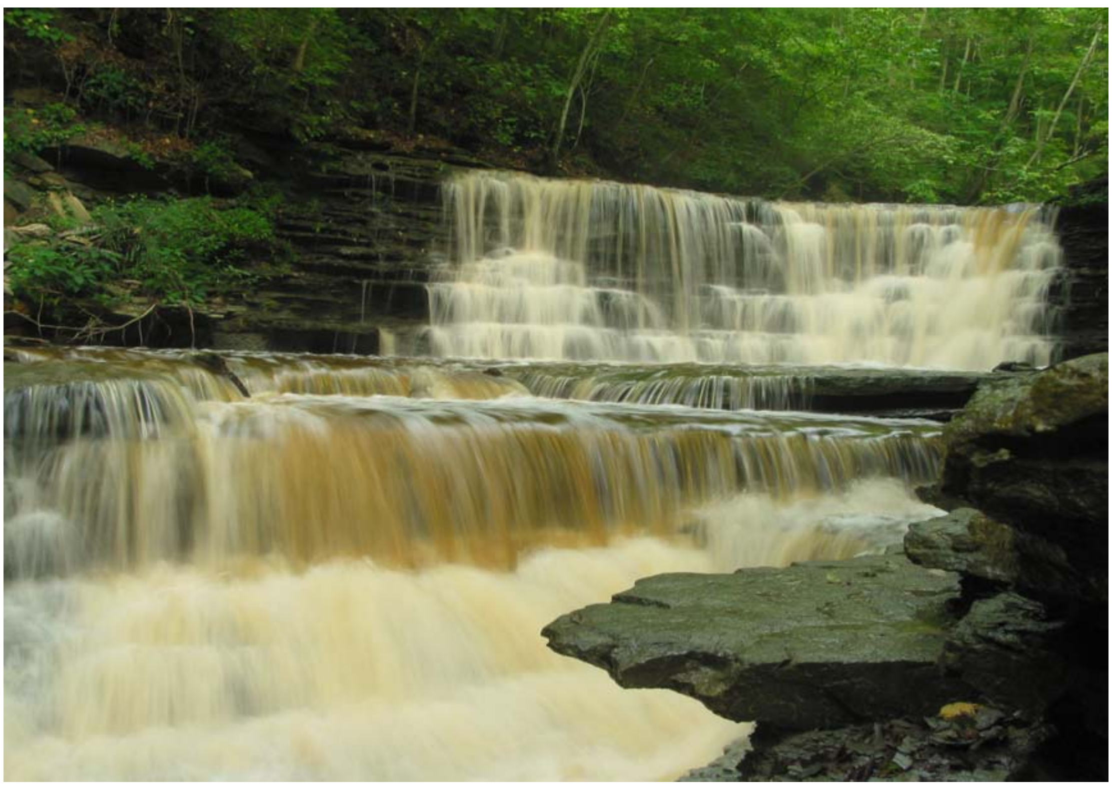
East Fork Watershed Collaborative

East Fork Little Miami River
Watershed Action Plan

Middle East Fork Watershed Action Plan

July 2009



Backbone Falls, Middle East Fork Watershed

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Introduction

East Fork
WATERSHED COLLABORATIVE

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CHAPTER 1: INTRODUCTION

Historically, environmental regulatory agencies have addressed water quality concerns by focusing on the discharges from “point sources,” the direct discharges from industrial facilities and municipal wastewater treatment plants. While controlling these discharges has significantly improved water quality in many streams, many others - including many streams within the East Fork Little Miami River watershed - remain impaired. Other possible sources of impairment include stormwater runoff, failing septic systems, and runoff from agricultural fields. To successfully manage pollutant loadings so that streams are “fishable, swimmable and drinkable” (the goals of the Clean Water Act), a watershed must be addressed as a whole, and all potential sources of pollution taken into account.

In 2000, the Soil and Water Conservation Districts in Brown, Clermont, Clinton and Highland Counties partnered with Clermont County to participate in the Ohio Department of Natural Resources Watershed Planning Program. A grant was received to fund a Watershed Coordinator for the East Fork Little Miami River Watershed, and the East Fork Watershed Collaborative was born.

The East Fork Watershed Collaborative (EFWC or “the Collaborative”) has accepted the responsibility for developing a watershed action plan (WAP) for the entire East Fork Little Miami River watershed. Due to the size of the East Fork watershed (500 mi^2 or almost 320,000 acres), and the variability in land use and stream conditions in various parts of the East Fork watershed, the EFWC made a decision to divide the overall watershed into smaller, more manageable subwatersheds for the purpose of planning. The subwatersheds selected as planning units are the Lower East Fork watershed, the Middle East Fork watershed, the Stonelick Creek watershed, the East Fork Lake Tributaries, and the East Fork Headwaters (see Figure 1-1).

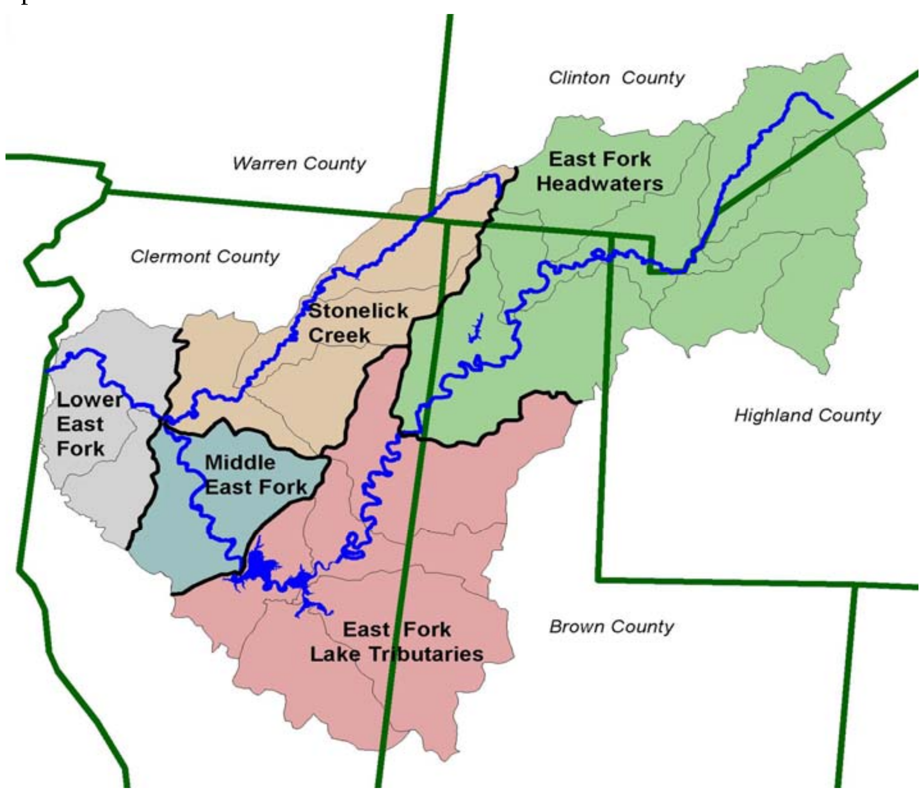

Figure 1-1. East Fork watershed planning units.

Subwatershed plans will focus on concerns unique to each subwatershed, providing a detailed description of subwatershed characteristics and stream conditions, causes and sources of water quality impairment, and specific recommendations on how those impairments might be addressed.

A watershed plan for the Lower East Fork was submitted to and endorsed by Ohio EPA and Ohio Division of Natural Resources (ODNR) in 2003. The Headwaters watershed plan was submitted to and endorsed by OEPA and ODNR in May 2006. The East Fork Lake Tributaries watershed plans was submitted and endorsed in September 2006. The EFWC is currently developing, and expecting to complete by December 2007, watershed plans for the Stonelick Creek subwatershed. Our final Watershed Action Plan for the East Fork Little Miami River will integrate the five subwatershed plans into a coherent whole, highlighting the connections and differences among the subwatersheds.

Middle East Fork Watershed Action Plan

This document represents the action plan for the Middle East Fork subwatershed, which consists of the entire East Fork drainage area upstream of Stonelick Creek to Harsha Dam (see Figure 1-1, p1). This plan contains the following sections:

- a watershed inventory, focusing on geology, soils, biological features, water resources, land use, point sources and non-point sources of pollution, and alterations to natural habitat;
- a summary of water resource quality in the Middle East Fork and its tributaries;
- a summary of community water management goals and interests;
- a discussion of watershed impairments, including an identification and quantification of potential pollutant sources, and recommended watershed restoration and protection goals.

The development of the Middle East Fork Watershed Action Plan (Middle East Fork WAP) was truly a team effort, with input from dozens of partners and participants. Some of those contributions are described here.

Watershed Inventory

The inventory requirements to receive Ohio EPA and ODNR endorsement are outlined in the Appendix 8 update (Ohio EPA, 2003) to "*A Guide to Developing Local Watershed Action Plans in Ohio*" (Ohio EPA, 1997). A wide variety of data sources must be tapped to complete the inventory. This WAP inventory includes information contributed by:

- Clermont County GIS Department;
- Farm Service Agencies of Clermont County;
- Soil and Water Conservation District of Clermont County;
- Clermont County Health District;
- Ohio Department of Natural Resources, US Geological Survey, U.S. EPA, and Ohio EPA;
- Clermont County Office of Environmental Quality (OEQ), Ohio-Kentucky-Indiana (OKI) Regional Council of Governments, and the Little Miami River Partnership.

(Apologies to those not mentioned.)

Water Resource Quality

Use attainment and water quality information was compiled from Ohio EPA and Clermont OEQ data.

Community Water Resource Management Interests

The success of any plan requires buy-in from those with the ability to implement the recommendations of the plan. For the Middle East Fork WAP, every effort was made to involve local community members (landowners, business owners, elected officials, county agency staff, …) in defining the local water management goals, and developing appropriate strategies for meeting both water quality and water quantity management objectives.

East Fork Watershed Collaborative

The East Fork Watershed Collaborative was formed in 2001 to provide local agencies, groups and individuals the opportunity to collaboratively plan and implement water quality improvement projects. The Collaborative's mission is "to enhance the biological, chemical and physical integrity of the East Fork Little Miami River and its tributaries."

The Collaborative is an informal organization (i.e., no application has been made for legal non-profit status), structured to minimize hierarchy/bureaucracy while maintaining effectiveness and accountability. The EFWC Steering Committee consists of representatives from four counties and five subwatersheds within the East Fork Little Miami River watershed. Four of the Steering Committee members are directly appointed by the Board of Commissioners for Brown, Clermont, and Highland counties. Four additional members represent the Soil and Water Conservation Districts of Brown, Clermont, Clinton and Highland counties. The final five Steering Committee members represent the five subwatershed planning areas (Lower East Fork, Middle East Fork, Stonelick Creek, East Fork Lake Tributaries, and East Fork Headwaters) by contributing knowledge about agriculture, industry, and other community resources and activities in the region. The Steering Committee is responsible for defining the scope and direction of the Watershed Program, providing direction to the Watershed Coordinator, and acting as liaison between the Collaborative and the local community.

Through a grant received from the Ohio Department of Natural Resources, the Clermont County Soil and Water Conservation District hired a Watershed Coordinator for the East Fork Little Miami River in December 2000. The Watershed Coordinator's position is supplemented with funding from the Clermont County Commissioners and the Soil and Water Conservation Districts from Brown, Clinton and Highland Counties. Jason Brown currently serves as the East Fork Watershed Coordinator. Anyone wishing to receive more information about this plan or the East Fork watershed in general can contact the East Fork Watershed Coordinator at (513) 732-7075.

EFWC Goals:

Provide direction and assistance to the East Fork Watershed Coordinator.
Provide guidance to the stakeholder groups involved in the development and implementation of the adopted watershed action plan.
Administer the terms and conditions of the ODNR – Watershed Coordinator Grant
Assist in the prioritization of recommendations in the watershed action plan.
Help identify funding opportunities that will assist in accomplishing the established objectives of the action plan.
Periodically reassess the stated objectives of the action plan and provide an evaluation of on-going efforts.
Periodically reassess changing conditions and needs in the watershed and oversee necessary revisions to the plan.
Serve as an informational resource for interested constituents relating the needs, conditions, and opportunities within the East Fork Watershed.
Provide technical assistance to the groups, organizations, and individuals in the watershed that are involved in activities effecting water quality and land use activities in the watershed.
Provide a forum for discussions across political boundaries about opportunities to improve water quality and the use of the resources throughout the East Fork Watershed.

EFWC Measures of Success:

Improvement in water quality in the East Fork Watershed
Increased public awareness of water quality in the East Fork Watershed
Degree of Implementation of recommendations from the Watershed Action Plan
Viability of the East Fork Collaborative and stakeholder groups
Increased usage of BMPs in the East Fork Watershed
Extent of protection and restoration provided to the riparian corridor in the East Fork Watershed
Decreased duplication in administrative efforts to protect water quality in the East Fork Watershed

Public meetings were used to review water quality information and sources of impairment, and to identify local water management challenges and interests.

The participatory process is more fully detailed in Chapter 4; Community Water Management Goals and Interests. A detailed list of stakeholders that participated in the planning process is provided in Chapter 4.

Watershed Restoration and Protection Goals

Chapter 5 of this document is where the rubber hits the road. This chapter describes water quality impairments by stream segment, details watershed management and restoration goals, and outlines recommended strategies (the who, what, where, when, how and how to pay) to meet the goals. The goals and strategies were developed and prioritized by key Middle East Fork stakeholders.

The action plan, as well as a wide range of educational materials, are available at the East Fork watershed page (www.eastforkwatershed.org).

Local Endorsement

Once the Watershed Action Plan has been fully endorsed by Ohio EPA and ODNR, the Collaborative will present the action plan to: the Board of Commissioners of Clermont County; the Village Councils of Batavia and Amelia; and the Batavia, Pierce, and Stonelick Township trustees during open public sessions. After each presentation, the appropriate Board or Council will either formally endorse the plan or make recommendations for any needed revisions. EFWC partners will review the watershed plan annually, and update the plan as needed.

Implementation and Evaluation

The implementation of any watershed plan requires the cooperation of landowners, local governments, local businesses and other stakeholders. The East Fork Watershed Collaborative continues to seek partners in implementing practices and programs that will improve water quality in the Middle East Fork and its tributaries. Many such activities are described in this document; however, the Collaborative will revisit this document with our project partners on an annual basis to measure progress toward our goals, to review whether our goals and priorities are still appropriate, to solicit additional resources, and to direct available resources where they are most needed.

For a summary of previous watershed efforts and ongoing implementation projects sponsored by the East Fork Watershed Collaborative, see Appendix A.

Information and Education

The information and education component will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the non-point source management measures that will be implemented.

Education and Outreach Component

The Collaborative and its partners have a strong education component in place for the Middle East Fork. The primary objective is to raise awareness about water quality and watershed management in the Middle East Fork subwatershed. Education and outreach will be conducted as a joint effort between: East Fork watershed coordinator, Clermont Soil and Water Conservation District, OSU Extension, Farm Bureau, Clermont County Health District, Clermont County Water and Sewer District, Clermont County Office of Environmental Quality, and other EFWC partners. Current and complimentary education and outreach programs in the entire East Fork Watershed are summarized in Appendix A. Education and Outreach management actions, resources, time frame, and performance indicators can be found in Chapter 5; Watershed Recommendations.

Information Component

All records and documents pertaining to the entire East Fork Watershed will be kept by Clermont Soil and Water Conservation District (SWCD) and Clermont Office of Environmental Quality (OEQ). The Watershed Action Plans, watershed management reports, water quality data, soil survey data and information on local projects can be accessed through the Clermont SWCD and OEQ offices.

Final documents of the Middle East Fork WAP will be available on CD at Clermont Soil and Water Conservation District, Clermont OSU Extension office, and will be downloadable from the OEQ website at www.oeq.net and from Clermont SWCD web site at www.eastforkwatershed.org Final copies will also be sent to local library branches in the Middle East Fork region of Clermont County.

To receive a copy of the Middle East Fork Watershed Action Plan contact the East Fork Watershed Collaborative at (513) 732-7075.

Middle East Fork Watershed Action Plan

Chapter Two

Watershed Inventory

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CHAPTER 2: WATERSHED INVENTORY

A number of factors - both natural and manmade - influence the quantity and quality of water in our streams. These factors include: the underlying geology and the soils that formed over thousands of years; the local climate and, in particular, precipitation; the type and location of surface water bodies including wetlands, lakes, reservoirs, streams and rivers; land use; and point and non-point sources of pollution. The purpose of a watershed inventory is to catalog these factors in a way that helps us understand the natural and human impacts on the condition of our water resources.

Location

The Middle East Fork watershed is 37.8 square miles (24,199 acres) and is located in Clermont County (see Figure 2-1). Approximately 95% of the Middle East Fork watershed falls within Batavia Township. The headwaters of Lucy Run begin in Pierce Township and the headwaters of the west fork of Backbone Creek begin in Stonelick Township. The Villages of Batavia and Amelia fall within the Middle East Fork watershed.

Geology

Geology influences watershed management in several ways. As an example, different bedrock materials and overlying soils have different levels of susceptibility to erosion by water (erodibility). Also, the composition of the bedrock material and soils are primary natural factors governing the shape and slope of the stream bed and, ultimately, the depth and velocity of water running through the channel. In addition, porous material such as sand, gravel or limestone can act as a conduit and/or reservoir for ground water, whereas solid bedrock, clays and shales serve as barriers to subsurface water flow.

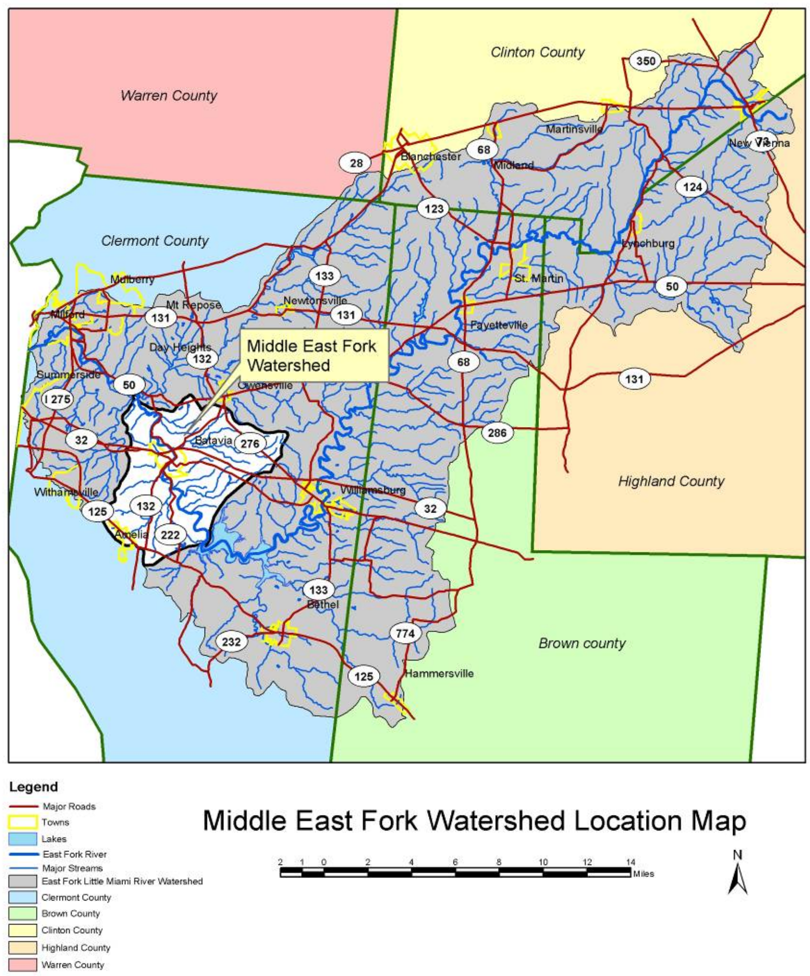


Figure 2-1. Location of the Middle East Fork Watershed.

The underlying geology of the Middle East Fork is primarily interbedded shale and limestone of Ordovician age (450 million years ago). This bedrock is overlain by Illinoian glacial cover (Figure 2-3) and a relatively shallow layer of loess from a few to as much as 40 inches in depth.

The glacial cover in the Middle East Fork is a clayey till of Illinoian Age. This clay layer is situated above the bedrock but below the soil, often creating an impermeable layer preventing infiltration into the bedrock below. The glacial cover of the Illinoian till plains is generally 10 to 30 feet thick, covered with a loess cap of 18-40 inches in depth. The levelness and poor permeability of the Illinoian till plains create an ideal environment for crayfish, and this area is sometimes called the "Crawdad Flats."

Slope also affects runoff and erosion rates. Level areas tend to store water in depressions — whether puddle, wetland or ditch — slowing the rate of runoff and encouraging infiltration or evaporation. Steeper topography yields more runoff, faster surface water flow and increased erosion, increasing the potential for surface runoff to carry eroded soil to water bodies. Similarly, steeper stream channels have higher stream velocity that, in turn, can increase streambank erosion. A map of slope for the Middle East Fork watershed is shown in Figure 2-2.

Soils

Soil plays an extremely important role in watershed management. For example, in many watersheds soils act as natural water filters. Certain soil types are prone to flooding or erosion, affecting runoff rates and sedimentation. An understanding of soil types, with their benefits and limitations, leads to more effective land use management. The following paragraphs provide a summary of soil characteristics in the Middle East Fork watershed.

The United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) in conjunction with ODNR Division of

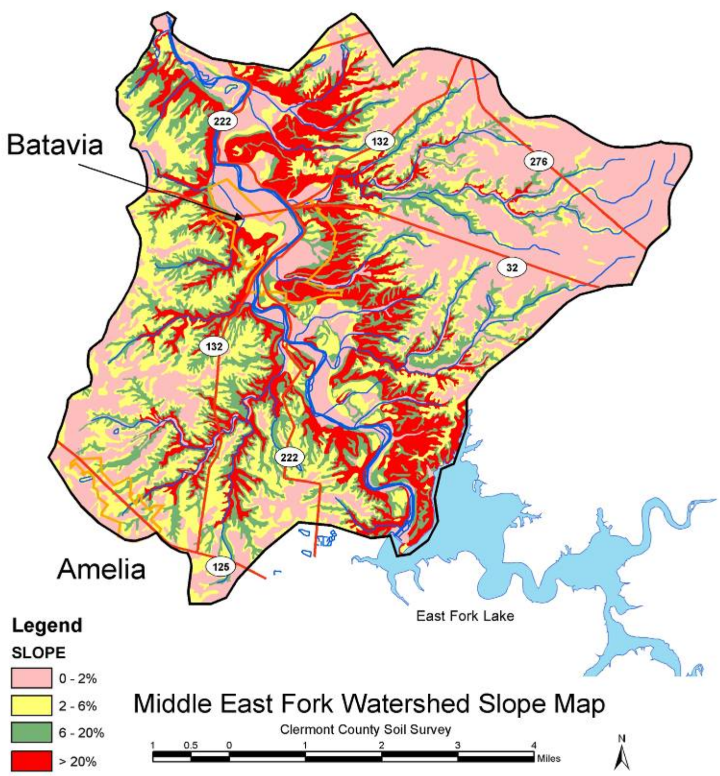


Figure 2-2. Slope in the Middle East Fork Watershed.

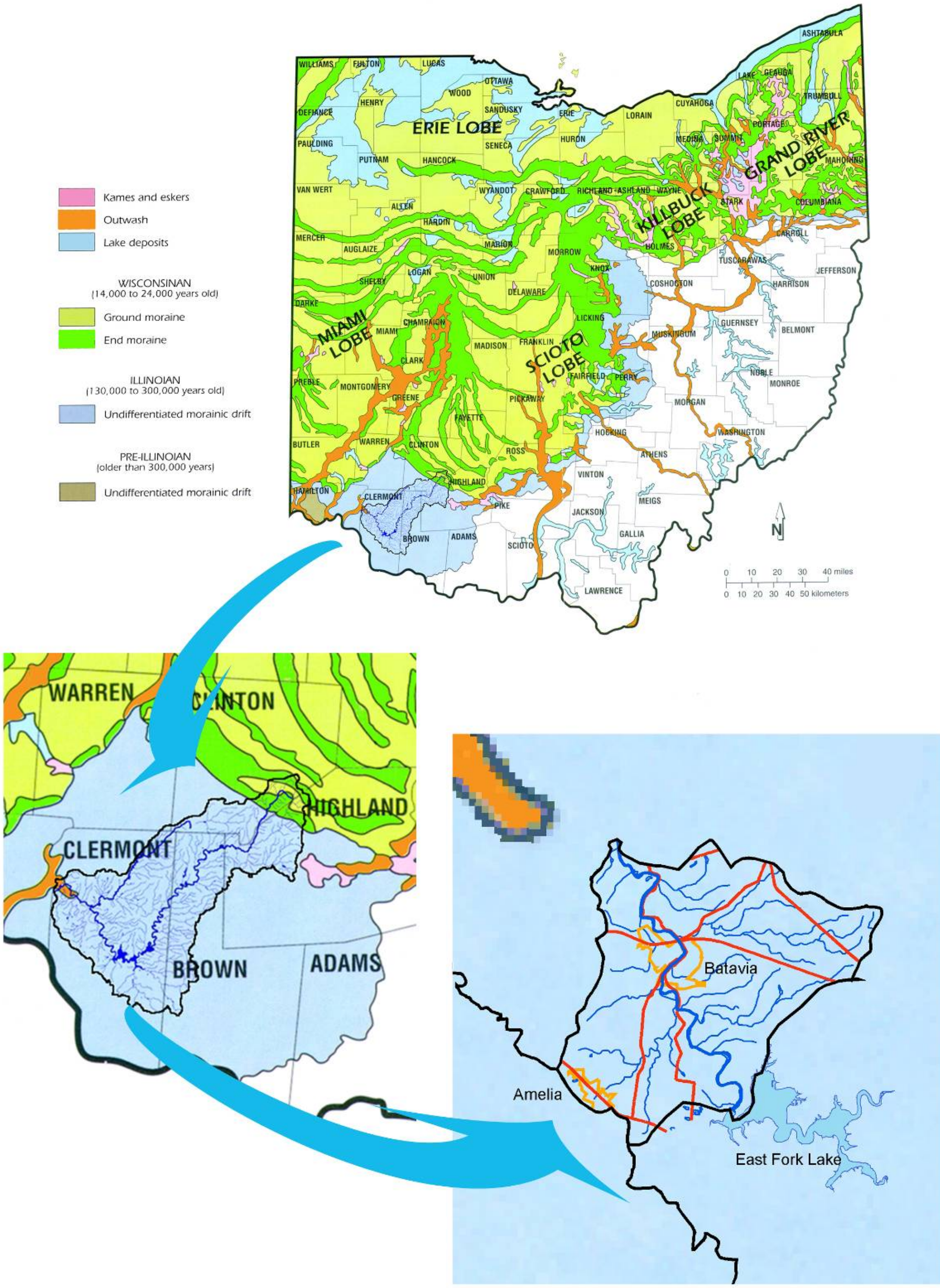


Figure 2-3. Glacial Geology of Ohio and the Middle East Fork Watershed.

Soil and Water Conservation identified six soil associations (i.e., groups of soil series found in conjunction). Figure 2-4 illustrates the distribution of soil associations within the Middle East Fork watershed. [Note: A finer level of detail, including maps of individual soil series, can be seen in the Soil Surveys of the individual counties. Contact your county Soil and Water Conservation District to obtain a copy.]

Table 2-1 describes the most common soil series in the Middle East Fork watershed, and provides information on the permeability, drainage and runoff characteristics of each.

Most Common Soil Series in the Middle East Fork Watershed

Genesee-Williamsburg association: Deep, nearly level to moderately steep, well drained soil on stream floodplains and terraces. Genesee-Williamsburg soils are important and valuable as cropland in Clermont county. They are easily worked in spring, and if properly managed, they are well suited to crops generally grown in the county, such as corn and soybeans.

Edenton-Eden association: Moderately deep, moderately steep to very steep, well drained soils on walls of upland valleys. Edenton-Eden soils are mostly in woods and pasture. These soils are mostly on valley walls along the major drainage streams of Clermont county.

Hickory-Cincinnati-Edenton association: Deep and moderately deep, mostly moderately steep to very steep, well drained soils on valley sides and tops of narrow ridges. Hickory soils are used mostly for woods or pasture. In some areas Cincinnati soils are used as sites for small estate and subdivision housing.

Rossmoyne-Cincinnati association: Deep, mostly gently sloping to sloping, moderately well drained and well drained soils near major drainageways and on tops of broad ridges. In some areas of Clermont county these soils are used extensively for small estates and subdivisions.

Avonburg-Clermont Association: Deep, nearly level to gently sloping, somewhat poorly drained and poorly drained soils on uplands. Avonburg soils are used mostly to grow such cultivated crops as corn, wheat, and soybeans; however, some areas are in woods or pasture. If the soils are cultivated, they need drainage, which is commonly accomplished with surface ditches and raised beds. Clermont soils are also mostly used for crops. A considerable acreage is wooded, mainly in scattered farm woodlots 5 to 60 acres in size. Some areas that are not now farmed are reverting to wooded areas. These areas have a thick volunteer growth of red maple, pin oak, and sweetgum trees.

Blanchester-Clermont association: Deep, nearly level, poorly drained soils in slight depressions and swales and on broad flats. If Blanchester soils are adequately drained, they are commonly used to grow such cultivated crops as corn and soybeans. Many acres of Blanchester soils are not farmed because they are poorly drained or ponded for part of the year.

Sources: STATSGO, Clermont County Soil Survey (2002)

Table 2-1. Middle East Fork Soil Associations.

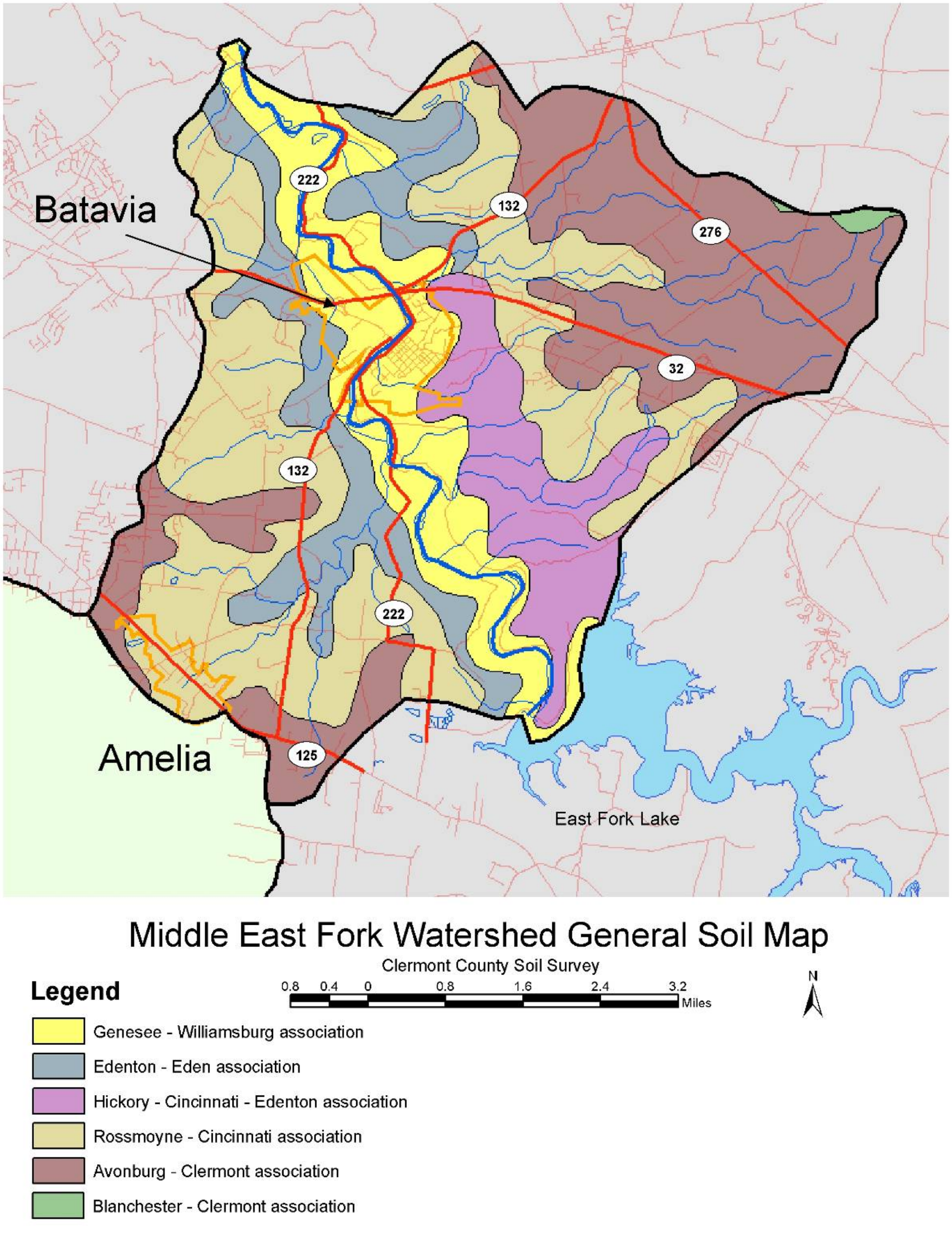


Figure 2-4. Soil Map of the Middle East Fork Watershed.

Biological Features

Figure 2–5. The Slenderhead Darter, a Rare Fish Species Found in the Middle East Fork Watershed. (photo courtesy of Konrad Schmidt)

The native vegetation of the Middle East Fork watershed was deciduous hardwood forest, though species composition varied based on soil moisture. In the better drained areas, white and red oak, beech, sugar maple and hickory were dominant, with elm, ash, black walnut, honey locust, and blackgum also present. Much of the watershed lies within the wetter, level areas of the Illinoian till plains where the dominant species were pin oak, soft maples, ash, elm, and swamp oak with beech and sweetgum also present. Sycamore, boxelder, hackberry, willow and cottonwood were common in bottom-land forests.

The Ohio Department of Natural Resources, Division of Natural Areas and Preserves maintains a list of rare, threatened and endangered species in the State of Ohio, including endangered species of fish (see Figure 2-5) and macroinvertebrates. Species found in the Middle East Fork considered to be endangered, threatened or of special concern are summarized in Table 2-2 and Figure 2-6. Animal communities of special significance, such as mollusk beds, are also included.

It is important to note that these are confirmed occurrences of these species, and other rare plant and animal species are likely present in the watershed, but haven't been identified. Occurrences of rare plant and animal species may be reported to the Ohio Department of Natural Resources, Division of Natural Areas and Preserves (614-265-6453; http://www.ohiodnr.com/dnap/about.htm).

Invasive Nonnative Species

Numerous invasive plant species are common throughout the East Fork Watershed. These in-

Common Name	Scientific Name	Federal Status	State Status	Location
Rare Plant List				
Blue False Indigo	Baptisia australis		Endangered	East Fork State Park
Carolina Willow	Salix caroliniana		Threatened	East Fork State Park
Few-flowered Tick-trefoil	Desmodium pauciflorum		Potentially Threatened	East Fork State Park
Southern Wapato	Lophotocarpus calycinus		Potentially Threatened	
Prairie Wake-Robin	Trillium recurvatum		Potentially Threatened	East Fork State Park
Rare Animal List				
Fawnsfoot	Truncilla donaciformis		Threatened	East Fork Little Miami River
Salamander Mussel	Simpsonaias ambigua		Species of Concern	East Fork Little Miami River
Wavy-Rayed Lampmussel	Lampsilis fasciola		Species of Concern	East Fork Little Miami River
Pink Papershell	Potamilus ohiensis		Not-listed	East Fork Little Miami River
Giant Floater	Anodonta grandis corpulenta		Not-listed	East Fork Little Miami River
Slenderhead Darter	Percina phoxocephala		Species of Concern	East Fork Little Miami River
Rough Green Snake	Opheodrys aestivus		Species of Concern	East Fork State Park

Table 2-2. Rare, Threatened and Endangered Species in the Middle East Fork Watershed.

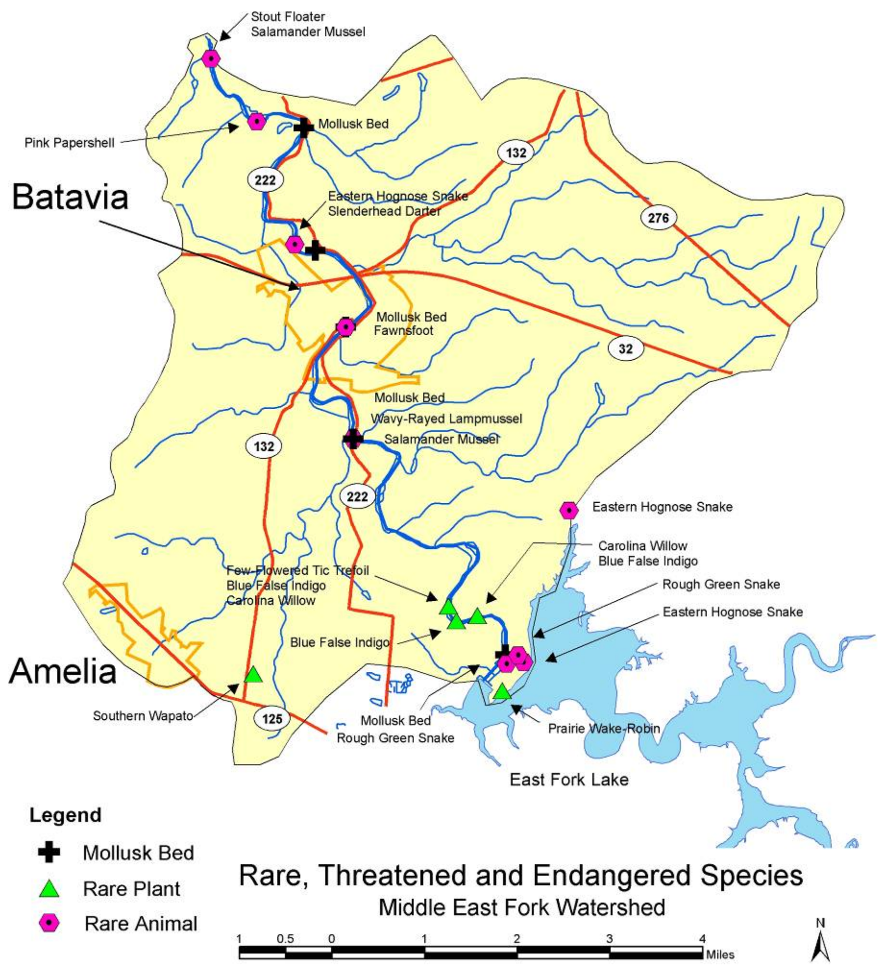


Figure 2-6. Rare, Threatened and Endangered Species of the Middle East Fork.

clude bush honeysuckle (*Lonicera* species), Japanese honeysuckle (*Lonicera japonica*), multi-flora rose (*Rosa multiflora*), and garlic mustard (*Alliaria petiolata*) (see Figure 2-7). Each of these plants have negative impacts on other vegetation and/or animals within the watershed.

Bush and Japanese honeysuckle out-compete and displace native plants and alter natural habitats by decreasing light availability and depleting soil moisture and nutrients for native species. Exotic bush honeysuckle compete with native plants for pollinators, resulting in reduced seed set for native species. Unlike native shrubs, the fruits of exotic bush honeysuckles are carbohydrate-rich and do not provide migrating birds with the high-fat content needed for long flights.

Multiflora rose forms dense thickets, excluding most native shrubs and herbs from establishing and may be detrimental to nesting of native birds. This species was once encouraged by Soil and Water Conservation Districts for living fences and wildlife habitat, however it is no longer encouraged.

Garlic mustard invades areas disturbed by human activities and appears to be aided by white-tailed deer that prefer to eat native wildflowers and leave garlic mustard untouched. Garlic mustard displaces many native spring wildflowers such as spring beauty, wild ginger, bloodroot, Dutchman's

Figure 2-7. Common Invasive Species Located within the East Fork Watershed: A) Bush Honeysuckle B) Japanese Honeysuckle C) Multi-flora Rose D) Garlic Mustard.

Photos courtesy of ODNR Division of Natural Areas and Preserves. For more information regarding invasive species in your area contact your local Soil and Water Conservation District.

breeches, toothworts and trilliums that occur in the same habitat. It is also credited with the decline of the West Virginia white butterfly because chemicals in garlic mustard appear to be toxic to the butterfly's eggs.

Invasive nonnative plant species are not the only threat to the East Fork Watershed. Zebra mussels (***Dreissena polymorpha***) (Figure 2-8) are rapidly spreading throughout the Midwest. Zebra mussels and a related species, the Quagga mussel, are small, fingernail-sized mussels native to the Caspian Sea region of Asia. They are tolerant of a wide range of environmental conditions and have now spread to parts of all the Great Lakes, the Mississippi River, and the Ohio River. Zebra mussels clog water-intake systems of power plants and water treatment facilities, as well as irrigation systems, and the cooling systems of boat engines. They have severely reduced, and may eliminate native mussel species. No zebra mussels or Quagga mussels have been found in the East Fork Watershed. It is important, however, to continue to monitor the watershed for the presence of these aquatic invasives.

Figure 2-8. Zebra Mussels (*Dreissena polymorpha)* Attached to a Native Freshwater Mussel Shell. *This native mussel was suffocated by the attached zebra mussels.*

Climate and Precipitation

The entire East Fork watershed has a temperate climate characterized by well-defined winter and summer seasons. Historically, the coldest month is January, which has an average daily temperature of 26 degrees F, and average daily maximum and minimum temperatures of 35 and 18 degrees F, respectively (data taken from climate station at Hillsboro in central Highland County). The warmest month is July, with an average daily temperature of 74 degrees F, and maximum and minimum temperatures of 83 and 64 degrees F, respectively.

The average annual total precipitation ranges from 41-43 inches. Of this, about 17 inches (~40 percent) falls during the growing season between May and August. The months with the least amount of precipitation are January, February and October, all with average monthly totals of less than 3.0 inches. The wettest months, on average, are March, May, July, and August, each with average monthly precipitation amounts greater than 4.0 inches. Before June, rainfall events are typically more widespread, caused by frontal systems moving through the area. In the hotter months of July, August and the beginning of September, rainfall is more spotty in coverage, as convective, "pop-up" thunderstorms in the afternoon are common.

Surface Water

For purposes of this Watershed Action Plan, the Middle East Fork watershed is defined as the land area draining to the East Fork downstream of the dam at East Fork Lake to the confluence of Stonelick Creek (see Figure 1-1, p1-1). It consists of two 14-digit Hydrologic Unit Codes (HUCs), as defined by the U.S. Geological Survey:

- East Fork Little Miami River below Cloverlick Cr. to below Lucy Run (Split at Dam) (HUC 05090202-120-030)
- East Fork Little Miami River below Lucy Run to above Stonelick Creek (HUC 05090202-120-040)

There is one stream gauge maintained by the U.S. Geological Survey in the Middle East Fork. It is located near Bantam Road below the William H. Harsha Dam. The U.S. Army Corps of Engineers maintains a minimum stream flow release of 30 cfs (cubic feet per second) from the Harsha Dam discharge.

The Middle East Fork encompasses approximately 11.7 miles of the East Fork Little Miami River (EFLM) (Ohio Waterbody ID OH53-45, OH53-52, OH53-60; River Code 11-100) and three major tributaries to the EFLM (Lucy Run, Fourmile Creek and Backbone Creek). While Lucy Run and Fourmile Creek have been assessed by both OEPA and Clermont County, neither organization has performed any water quality surveys in Backbone Creek or any of the smaller tributaries in this area of the East Fork Little Miami River.

The mainstem of the EFLM within the subwatershed has received an "Exceptional Warmwater

Stream Name	OEPA Stream Code	Length (miles)	Drainage Area (sq. mile)	Stream Characteristics	Use Designation
Backbone Creek	11-115	5.4	8.55	Intermittent Stream	WWH, PCR, AWS, IWS
Lucy Run	11-116	2.4	7.25	Intermittent Stream	WWH, PCR, AWS, IWS
Fourmile Run	11-117	0.4	3.58	Intermittent Stream	WWH, PCR, AWS, IWS

Table 2-3. Significant Tributaries in the Middle East Fork Watershed. EWH (Exceptional Warm Water Habitat), WWH (Warm Water Habitat), PCR (Primary Contact Recreation), AWS (Agricultural Water Supply), IWS (Industrial Water Supply), PWS (Public Water Supply)

Habitat" (EWH) aquatic life use designation, meaning this waterbody has the potential to support exceptional biological communities. All of the streams that serve as tributaries to the EFLM (with the exception of Dodson Creek in the headwaters subwatershed) have been designated by Ohio EPA as Warmwater Habitat (WWH) streams. Also, all streams have been designated for Primary Contact Recreation.

The Middle East Fork watershed begins below William H. Harsha Lake. Stream flow along the East Fork mainstem is strongly influenced by Harsha Lake discharge. A minimum of 30 cfs (cubic feet per second) is released from Harsha Lake by the US Army Corps of Engineers. Daily discharge from Harsha Lake is determined by desired lake levels. Below Harsha Lake there are no significant lakes or reservoirs located in the Middle East Fork watershed. See the Lake Tributaries Watershed Action Plan for detailed information regarding Harsha Lake.

It should be noted that the Middle East Fork watershed is not in a Source Water Protection Area and provides no drinking source water to residents of Clermont County.

Wetlands

Most of the identified wetlands within the Middle East Fork watershed are small and isolated. The largest wetland area in the Middle East Fork is located along the East Fork mainstem nearly a mile above the confluence with Stonelick Creek. A map based on National Wetlands Inventory data is shown in Figure 2-9.

Ground Water

The majority of aquifers in the Middle East Fork are poor sources of ground water. The bedrock

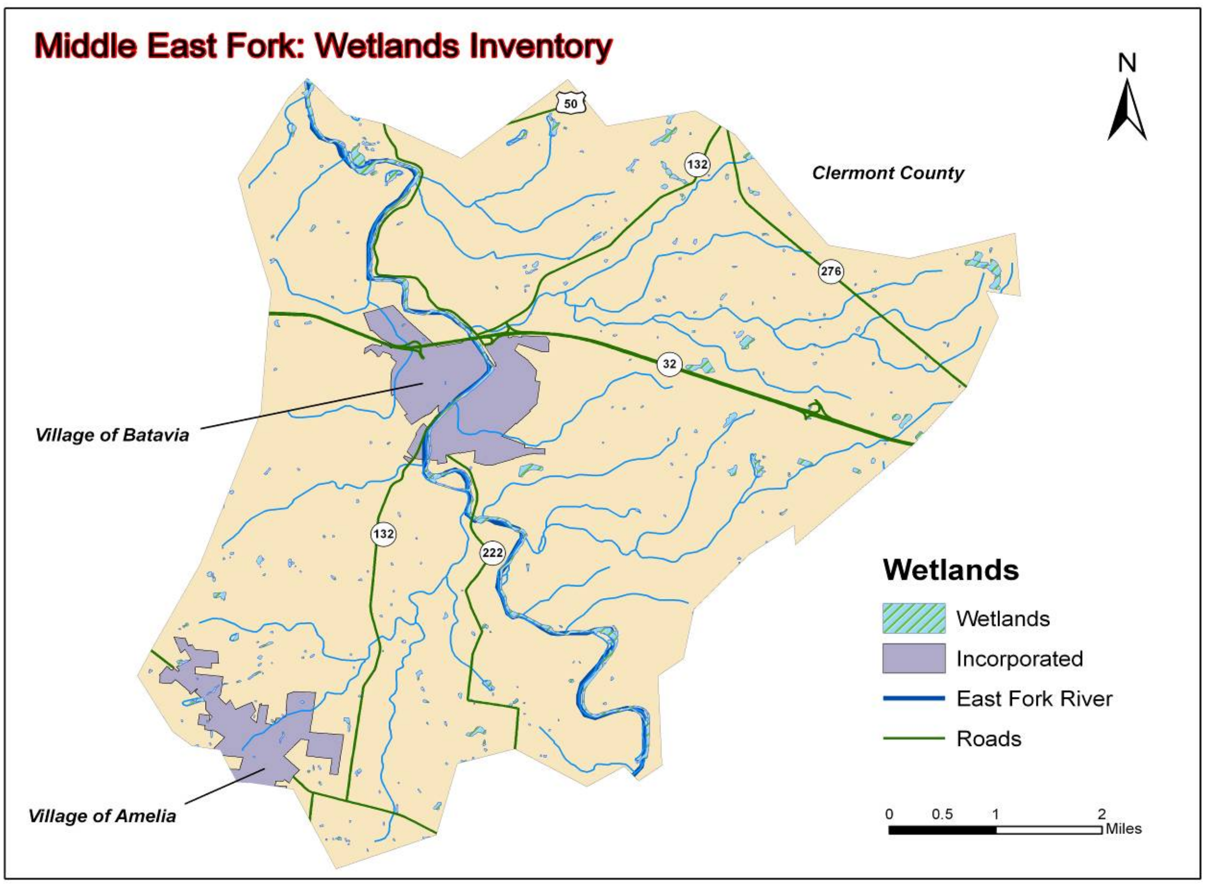


Figure 2-9. Middle East Fork Wetlands Inventory.

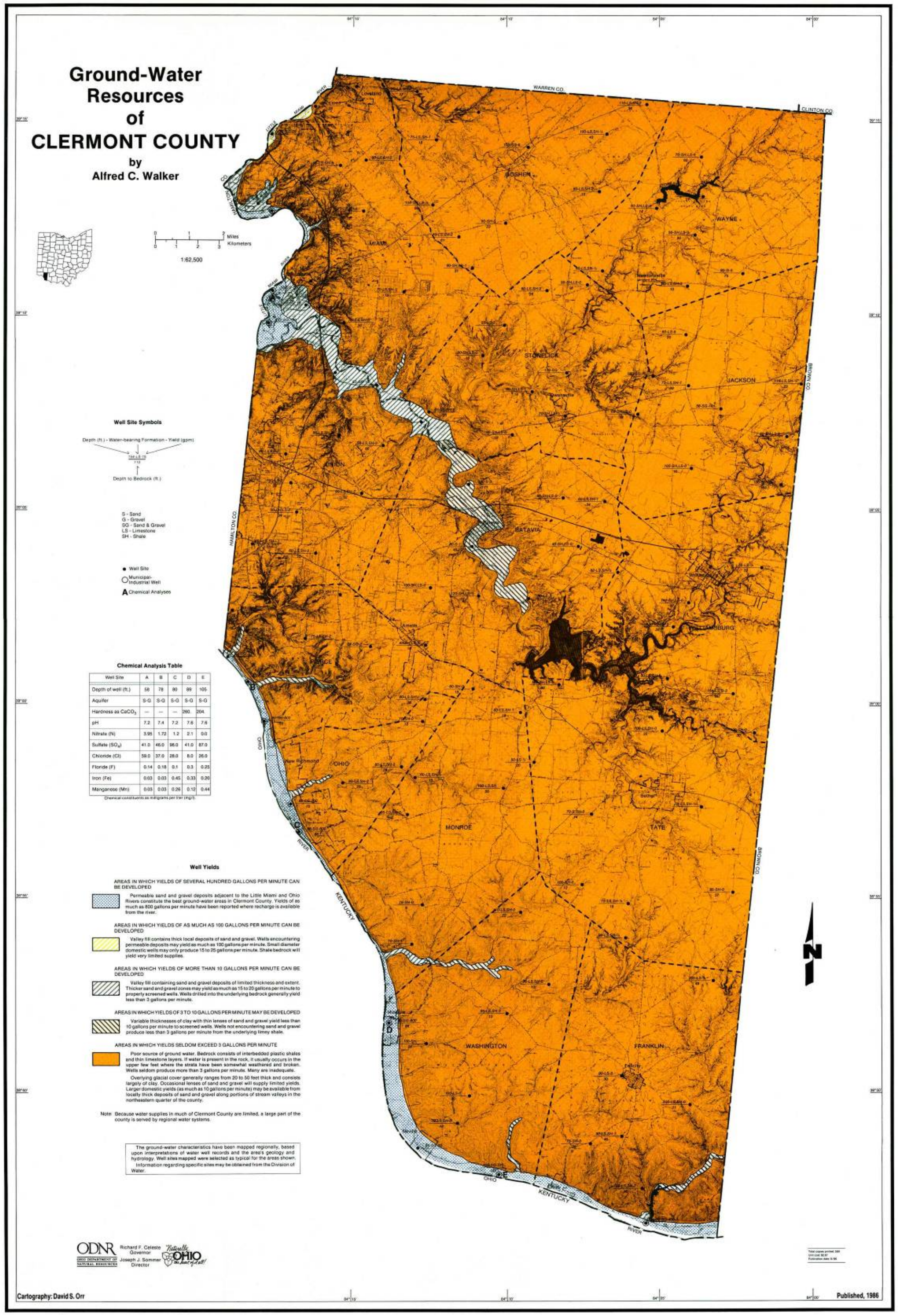


Figure 2-10. Ground Water Resource Map for Clermont County.
[source: http://www.ohiodnr.com/water/gwrmaps/counties/CLERMONT.htm]

consists of interbedded plastic shales and thin limestone layers and seldom yields more than three gallons per minute. The glacial cover ranges from 20 to 50 feet thick and is mainly clay. The highest yielding aquifer in the Middle East Fork is located along the East Fork mainstem. This valley fill aquifer contains sand and gravel deposits of limited thickness and extent. Yields in this aquifer can range between 10 to 20 gallons per minute.

Ground water areas sensitive to pollution in the Middle East Fork watershed are primarily located within riparian reaches and aquifer systems. There are no high risk areas located in the Middle East Fork. It is important to monitor areas for ground water pollution. See Appendix B for

Middle East Fork Demographics

The population characteristics of the Middle East Fork watershed were obtained using US census data from the years 1990 and 2000.

This is the fastest growing sub-watershed region within the larger East Fork basin. Data from the 2000 census indicates that approximately 20,765 residents live within the watershed. The average population density in the Middle East Fork is about 50 people per square mile (Figure 2-11). For comparison, the Lower East Fork Watershed (see Figure 1-1, p1-1), located in the eastern suburbs of Cincinnati (Eastgate, Union Township, Miami Township, Milford), has a population density of 1590 people/sq mi.

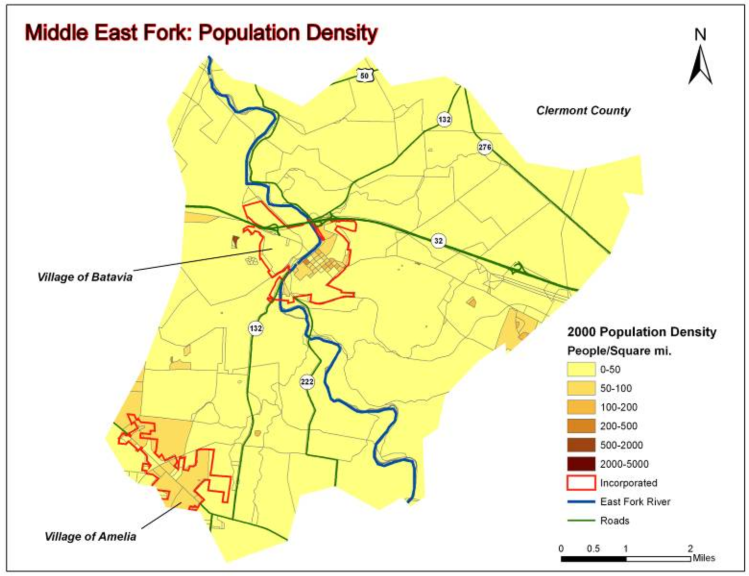


Figure 2-11. Population Density within Middle East Fork Watershed for the Year 2000.

Comparisons of the 1990 and 2000 census indicate a 75 percent increase in population in the Middle East Fork, from 11,898 to 20,765. Population growth is occurring evenly throughout much of the Middle East Fork within the Village of Amelia and all around the Village of Batavia. This increase in population is expected to continue.

Reference: U.S. Census Bureau Website (www.census.gov)

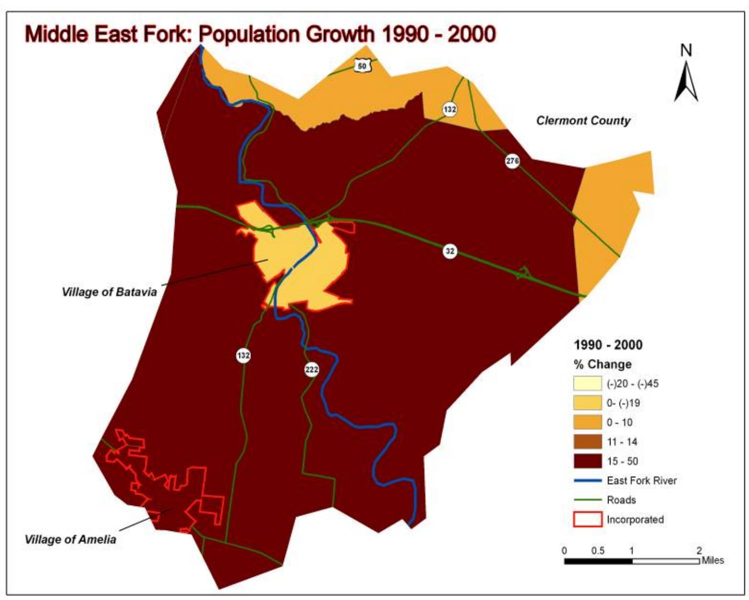


Figure 2-12. Population Growth within the Middle East Fork. watershed from 1990 to 2000.

ODNR Ground Water Pollution Potential Maps for Clermont County.

Land Use

Land use is a dominant factor in determining the overall condition of a watershed. The following sections present a summary of land use in the Middle East Fork watershed based on 2002 land use data (see sidebar for explanation). The Middle East Fork is a densely populated watershed. A drive through the watershed shows that residential and commercial land use is widespread and abundant. However, forest cover still dominants the landscape.

Based on 2002 land use data, it is easy to see the extent of forested land use in the Middle East Fork. Forested land use accounts for 48% of the land use, agriculture (e.g., corn, soybeans, dry herbaceous) account for 37%, while urban land use accounts for 7% (Figure 2-13). A map illustrating land use within the Middle East Fork watershed is shown in Figure 2-14.

It is important to note that these figures are based on 2002 land use data. The area of land used for forest and agriculture has undoubtedly declined since that time because of widespread rural residential development. The water management consequences of this type of unplanned rural development, sometimes referred to as "rural sprawl," are not fully understood.

Agriculture

Based on 2002 land use data, approximately 8,935 acres (37%) out of the total watershed area of 24,150 acres are used for agriculture. Of this, soybeans (7%) and corn (5%) are the dominant agricultural crops. A majority of this land class is composed of dry herbaceous vegetation, which includes stressed cropland and "Other Agricul-

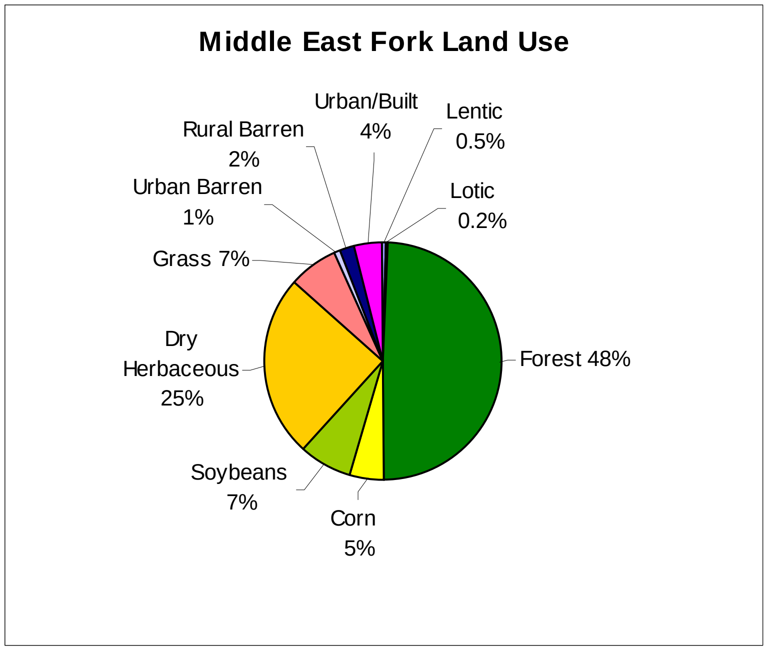


Figure 2-13. Distribution of Land Uses within the Middle East Fork Watershed.

Land Use Data Source

The land use data source used is from the 2002 high spatial resolution (4m x 4m) land use / land cover (LULC) dataset created by the USEPA for the entire Little Miami River watershed from remotely sensed imagery. This LULC classification was derived from 82 flight lines of Compact Airborne Spectrographic Imager (CASI) hyperspectral imagery acquired from July 24 through August 9, 2002 via fixed wing aircraft. Categories within this classification included water (both lentic and lotic), forest, corn, soybean, wheat, dry herbaceous vegetation, grass, urban barren, rural barren, urban / built, and unclassified. See sidebar on page 2-14 for detailed descriptions of all LULC classifications.

Reference: Troyer, M.E., J. Heo and H. Ripley. 2006 Classification of High Spatial Resolution, Hyperspectral Remote Sensing Imagery of the Little Miami River Watershed in Southwest Ohio, USA. U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Cincinnati, OH.

Land Cover Categories

From: ***Classification of High Spatial Resolution, Hyperspectral Remote Sensing Imagery of the Little Miami River Watershed in Southwest Ohio, USA.***
Prepared by USEPA Office of Research and Development

Lentic: Open water associated with still water systems, such as lakes, reservoirs, potholes, and stockponds. Such bodies typically do not have a defined channel or associated floodplain.

Lotic: Open water associated with running water systems, such as rivers or streams. Such waterways typically have a defined channel and an associated floodplain.

Forest: Contains either or both deciduous and coniferous trees in any degree of mixture. Single stemmed, woody vegetation with canopy spanning greater than 4 meters and tree canopy accounting for 25-100% of the cover.

Corn: Area under cultivation of food and fiber, where corn is the primary crop.

Soybean: Area under cultivation of food and fiber, where soybean is the primary crop.

Wheat: Area under cultivation of food and fiber, where wheat is the primary crop.

Dry Herbaceous: Dominated by dry and/or less vigorous herbaceous vegetation; herbaceous vegetation accounts for more than 25% of the ground cover. This class mainly includes naturally occurring and unmanaged herbaceous vegetation, and dried out, unhealthy, or stressed croplands. Dry herbaceous vegetation prevailed in croplands, as well as, “Other Agriculture” lands (fallow, hay, pasture, or natural grassland prairies or fields), due to drought in the Summer of 2002, Dry herbaceous vegetation had little chlorophyll content and very similar spectral signatures without regard to vegetative species.

Grass; Dominated by cultivated grasses planted in developed settings for recreation, erosion control, or aesthetics purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.

Urban Barren; Composed of bare soil, rock, sand, silt, gravel, or other earthen material with little (less than 25%) or no vegetation within urban areas. Examples include exposed soil in urban areas and constructions sites.

Rural Barren; Composed of bare soil, rock, sand, silt, gravel, or other earthen material with little (less than 25%) or no vegetation in rural areas. Typically fallow fields are included in this class too.

Urban/Built; Areas covered by structures and impervious surfaces in urban, suburban, and rural areas. Typically buildings, parking lots, and paved roads.

Unclassified; This class includes areas of image gaps among flight-lines and cloud cover where land cover classification was not feasible.

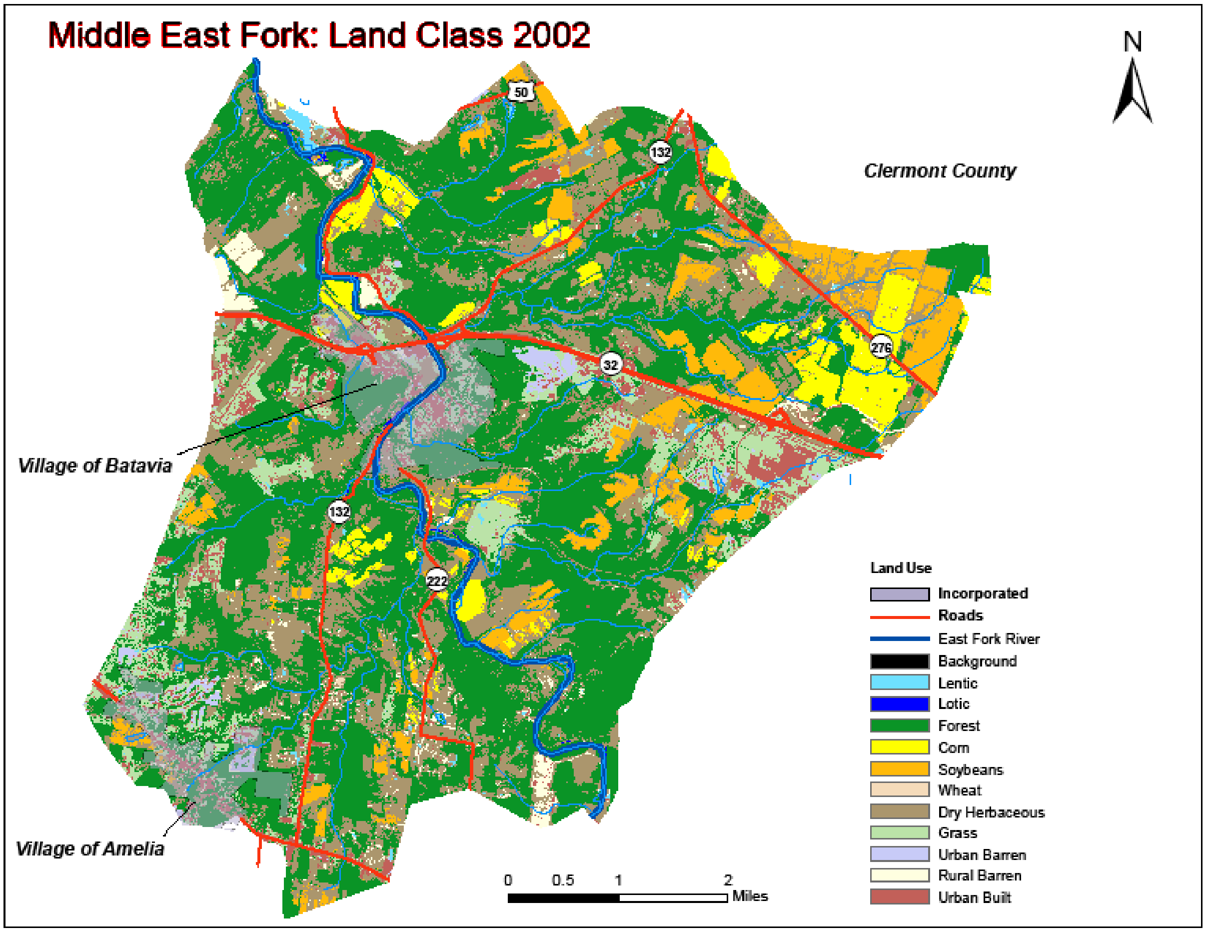


Figure 2-14. Land Use in the Middle East Fork Watershed (1997).

ture" lands (i.e., fallow, hay, pasture, or natural grassland prairies or fields). These lands represent marginal areas between urban and agricultural land use.

Forest

According to the 2002 land use data, forested areas comprise approximately 48% (11834 acres) of the Middle East Fork watershed. Forested areas typically support a healthy watershed. Root systems help to prevent soil erosion, aiding water infiltration into the soil while preventing excess sediments from entering water bodies. Forested areas along streambanks help to increase the stability of the stream channel by preventing erosion. Riparian forestation also provides shade to streams, which helps maintain desirable water temperatures and dissolved oxygen levels.

Light Urban Development - Residential and Commercial

Compared to other parts of the East Fork watershed the Middle East Fork is a densely populated watershed with a high percentage of residential and commercial land use, totaling 3,211 acres (14%). This category of land use includes residential, institutional (schools, churches, etc.) and commercial property.

Within the Middle East Fork, the majority of residential development historically has been concentrated within and around the Village of Batavia, but increasingly the building of homes or siting of manufactured homes on large rural lots has become a popular alternative for homebuyers.

This watershed also has several commercial areas within the villages of Batavia and Amelia and along major roads (e.g., U.S. 32 and S.R. 125). Commercial lands are notable because of their high percentage of impervious area.

Expected Development

Changes in population growth and land use are largely driven by transportation planning. The Eastern Corridor Transportation Project is a regional, multi-modal project that has potential to impact the Middle East Fork watershed. The study area extends from the Cincinnati Central Business District/riverfront redevelopment area in Hamilton County, east to the I-275 outerbelt in Clermont County (Figure 2-15). While the multi-modal project includes plans for extended bus service, bike trails, and a new commuter rail line, the crux of the project involves expanding interstate highway connectivity. Access improvements and road expansion along SR 32 in Eastgate will directly affect the following communities: Amelia, Batavia, Milford, Batavia Township, Miami Township, Pierce Township, Stonelick Township, and Union Township. Over 95% of the Middle East Fork falls within Batavia Township.

The multi-modal transportation improvements proposed for the Eastern Corridor will further improve connectivity in the area by providing better connections to the interstate system and better links from the area's economic centers in Cincinnati and Hamilton County to developing residential areas in eastern Hamilton and western Clermont County.

Clermont County is currently the only Cincinnati suburb not directly connected by interstate highway to the employment and economic core of Cincinnati and Hamilton County.

Community Planning

In 2008, the Clermont County Planning Department began working towards developing a Comprehensive Plan for the County. This initiative was modeled after the Ohio-Kentucky-Indiana Regional Council of Government's (OKI) Regional Policy Plan—a guide for developing long range growth management plans. However, a number of factors, including budgetary limitations, have stalled these efforts indefinitely.

Planning for growth and development in Clermont County has been initiated by the Townships. In the early 2000's, many of the local Townships began developing Growth Management Plans and Land Use plans in anticipation of continued growth and development. Batavia Township developed their Growth Management Plan in 2004. Batavia Township set five main priorities for land use and growth management: 1. Protect environmentally sensitive areas; 2. Preserve the character of Batavia Township; 3. Establish high standards for future development; 4. Plan and coordinate with other public, government agencies regarding provision of services and infrastructure; 5. Improve and increase park, active recreation and open space facilities for Batavia Township residents.

The Township included floodplain areas, steep slopes, significant forested areas, and water features such as Harsha Lake, the East Fork Little Miami River, stream corridors, and East Fork State Park as environmentally sensitive areas. The strategies to protect these areas include modifying zoning regulations to provide additional controls for development, investigate the creation of buffer zones or "no build" regulations, utilize conservation easements and other financial incentives, among other strategies.

As referenced in the Growth Management Plan, Batavia Township's population has increased at a steady rate since 1960. Between 1990 and 2000, Clermont County's population increased by 18% and Batavia Township increased by 33%. Population estimates, based on census zoning permit data from 2000, indicated that the population of Batavia Township to be 17, 816 in 2004, which represented an 18% increase since 2000. Projections based on the 2000 census data assume a 2.5% annual growth rate for Batavia Township, resulting in an estimated population of 26,000 residents by the year 2020.

Although residential and commercial development has slowed in recent year, the building trends indicate that growth will continue in Batavia Township. Zoning and Future Land Use maps for Batavia Township can be seen in Figure 2-16 and 2-17.

Potential Sources of Pollution — Non-point Source Inventory

Several factors determine the impact from non-point sources of pollution including type and characteristics of contaminants, the concentration of contaminants, soil type, percent impervious surface, amount of rain, and the presence of buffers or other best management practices (BMPs). The primary sources of non-point source pollution in the Middle East Fork watershed are discussed below.

Agriculture—Row Crop Production

Agriculture represents nearly 40% of the land use in the Middle East Fork, although it is not a major economic driver or way of life in the watershed. While it is often considered to be more ecologi-

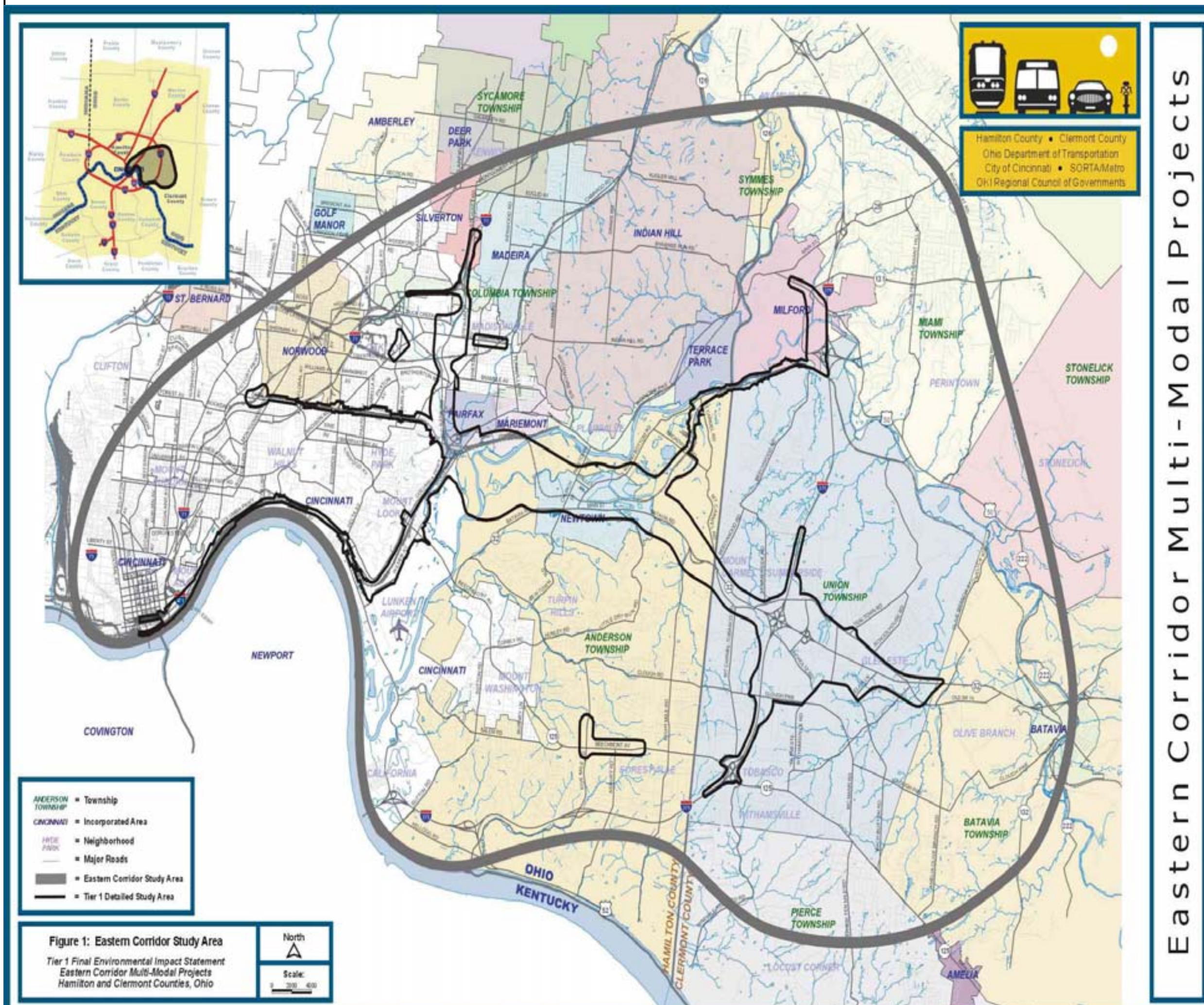


Figure 2-15. The Eastern Corridor Transportation Project study area including eastern Hamilton County and western Clermont County.

Economic Development: Improving Transportation and Enhancing our Economy

No industry impacts the quality of everyday life and the success of business more than transportation. Most of us recognize that increasing traffic congestion affects all of us, whether we are residents or business owners, by imposing unnecessary time delay, air pollution, safety and other costs upon travelers and business operations.

Adequate transportation facilities and supporting infrastructure are crucial for ensuring Clermont County's economic health and maintaining its competitiveness. The Clermont County Transportation Improvement District (CCTID) recognizes the changing nature of manufacturing, markets, trade and technologies has had dramatic impacts on the needs for movement of people, goods and services. These impacts have created new opportunities for economic growth in some areas but also risks of economic loss elsewhere.

Quite simply, future needs will likely not match the configuration of our transportation facilities and services developed 30+ years ago. Increasing globalization and international trade have led to new growth in movement of goods to and from marine ports, airport and border gateways, as well as new patterns of truck freight flow through our communities.

CCTID, realizing that our economic competitiveness is at stake, has begun to develop strategies, plans and construction projects to address not only the mobility needs of the people in our communities, but to address transportation's role in supporting the long-term economic well-being of our communities.

Clermont County Transportation Improvement District (CCTID)

The Clermont County Transportation Improvement District (CCTID) was established in June 2006, pursuant to O.R.C. 5540, by the Board of Clermont County Commissioners to foster increased collaboration with local partner jurisdictions, and other county, regional, state and federal agencies to implement a regional approach to transportation improvements in support of economic development in Clermont County.

CCTID is structured to provide combined technical, legal and financial capability to link transportation investments that foster economic development in Clermont County. All of the information provided in this section can be found on the CCTID website: http://tid.clermontcountyohio.gov/default.aspx

Environmental Stewardship: Improving Transportation and Enhancing our Environment

We all recognize that we need safe, efficient and effective transportation systems that connect us to our economy and built environment...our places of employment, churches, schools, recreation and shopping, as well as access to markets, suppliers and customers.

But it is increasingly clear that we must also recognize the importance and value of our connections to our natural environment as we jointly plan and develop our future transportation systems.

To minimize impacts on our environment, the Clermont County Transportation Improvement District (CCTID) and its partners are developing context-sensitive solution approaches and common-sense watershed-based mitigation strategies. By focusing on protecting and enhancing our environment, we can link important habitats, maintain and enhance our environment, and combine wetland mitigation and stream restoration and preservation with transportation investments.

CCTID is moving forward with the development of proactive environmental stewardship strategies that provide for broader mitigation strategies that support corridor or watershed based approaches and develops transportation investments that contribute to environmental stewardship through enhancing our green infrastructure.

Green Infrastructure

Green infrastructure is a strategically planned and managed network of natural areas, conservation lands, and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for our communities and people.

The green infrastructure network encompasses a wide range of landscape elements:

- ***natural areas*** - such as wetlands, woodlands, streams and waterways, floodplains, hillsides and wildlife habitat;
- ***conservation lands*** - such as public and private nature preserves, open space, greenways, and parks; and
- ***working lands of conservation value*** - such as rivers and streams, woodlands, farms, and nurseries, as well as utility areas such as storm water management facilities.

Green infrastructure is an essential component of the CCTID advanced mitigation planning concept protecting important ecological, cultural and historic resources while supporting the corridor-wide transportation and economic development strategy.

By incorporating strategies to enhance and protect our green infrastructure into the joint planning initiative and development of our transportation systems, CCTID is developing advanced mitigation opportunities to protect our important natural environment.

Advanced Mitigation Concept

Advanced mitigation of environmental impacts (mitigation actions undertaken now in anticipation of future transportation project impacts) should be implemented during the early stages of transportation planning.

By taking a proactive approach to mitigating impacts to the environment, high-quality sites that are under threat now can be protected:

- Identify and select the best available sites for habitat and wetlands mitigation during the early planning process before transportation projects are implemented.

- Integrate habitat conservation and water quality protection with advanced mitigation strategies as elements of the corridor-wide green infrastructure.

- Integrate parks, cultural and historic sites with advanced mitigation strategies as a foundation of greenway system.

By going beyond the minimum regulatory impact mitigation requirements, this advanced mitigation planning is an important part of the comprehensive approach to community development that puts resource protection into the overall transportation funding strategy.

Mitigation Opportunities

The advanced mitigation strategy being developed by CCTID is a continuation of land use visioning work, Green Infrastructure Planning, Tier 1 studies and resource agency and public input, to provide opportunity for a watershed-based mitigation approach and coordination with local watershed and conservation programs.

This coordination effort supports the watershed management objectives outlined in Chapter 5 (Watershed Recommendations), incorporates objectives of Clermont County's Project XLC Phase I agreement and Phase II Stormwater Management Planning, and is also being structured as part of the CCTID local match contribution to transportation improvements through an integrated funding approach.

A number of advanced mitigation opportunities have been developed to date and have been posted to Ohio EPA Mitigation Clearinghouse website to facilitate the exchange of information about potential sites for wetland and stream mitigation. Interested parties submit information on the Ohio EPA Data Sheet and Ohio EPA enters that information into a database. Submitted projects may be viewed by anyone interested in finding potential mitigation areas by clicking on the Map (see below).

http://www.epa.state.oh.us/dsw/MCH/map_index.html

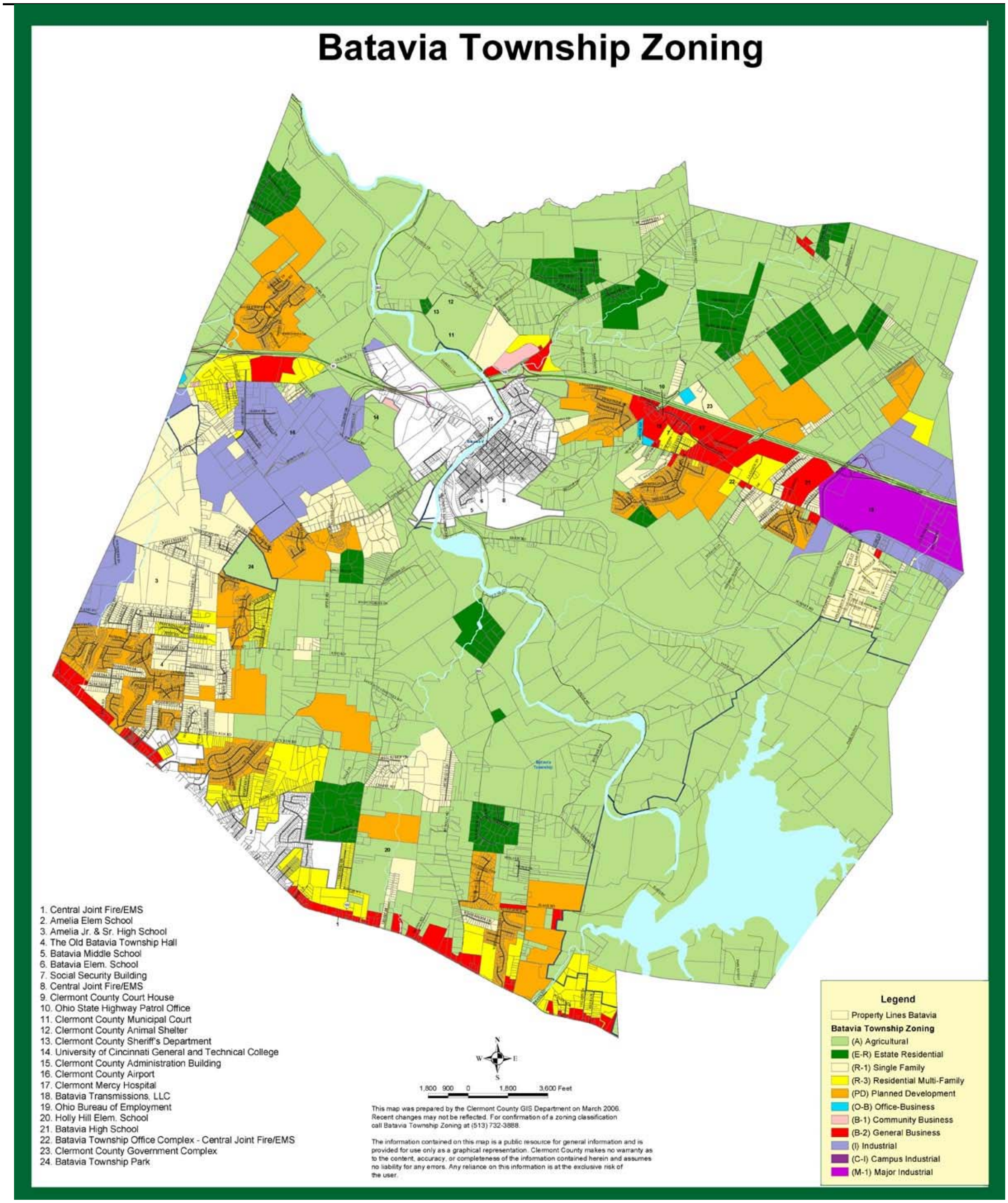


Figure 2-16. Batavia Township Zoning Map courtesy of Clermont County GIS Department and Batavia Township

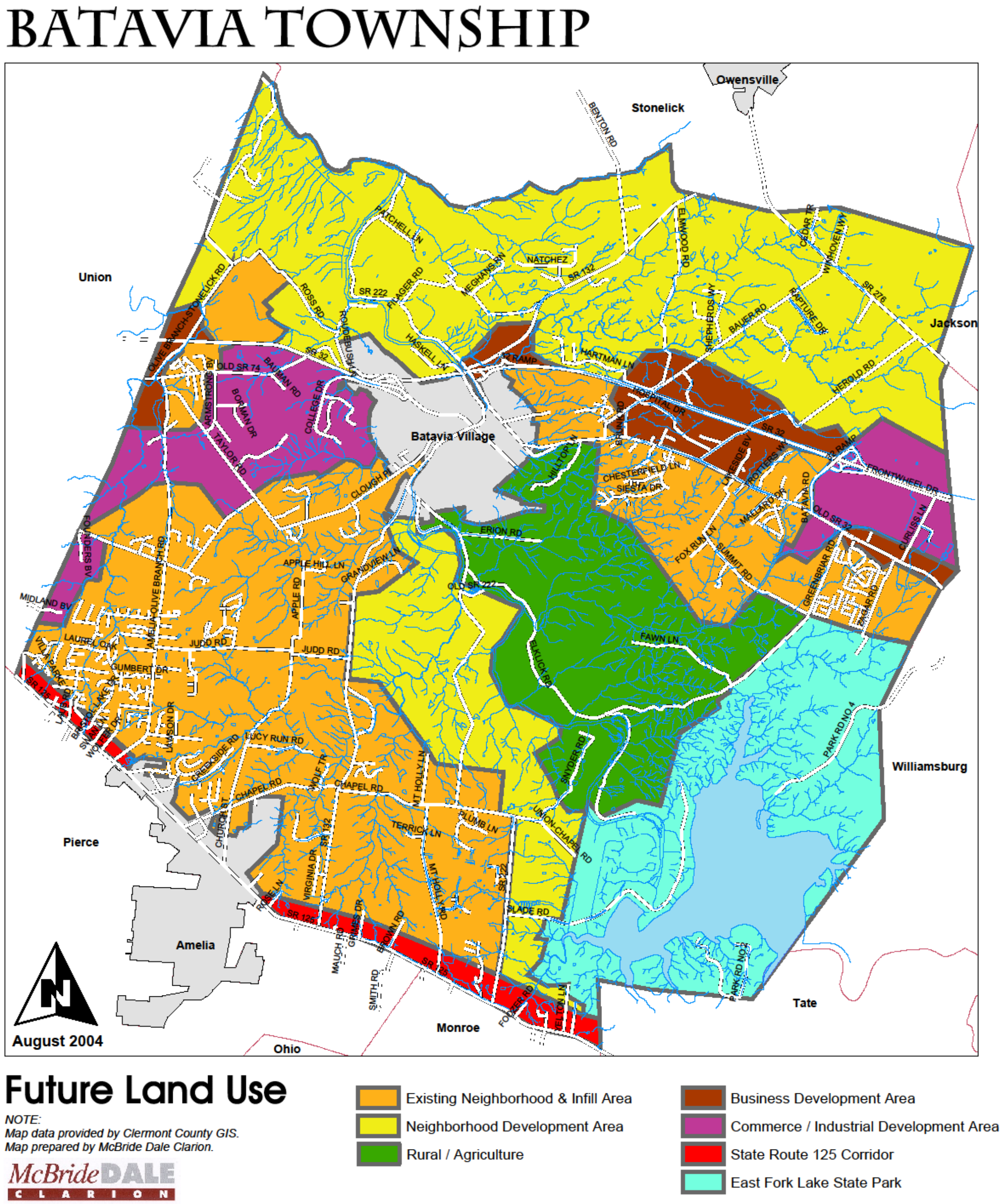


Figure 1

Figure 2-17. Batavia Township Future Land Use Map

cally sound than residential or commercial development, agriculture can have significant impacts on water quality. The heavy use of fertilizers and pesticides can contribute nitrogen, phosphorus and toxic chemicals to surface waters via storm water runoff and soil erosion. Conventional tillage practices can also contribute excess sediments through accelerated topsoil erosion. Sedimentation has the potential to alter the path and flow regime of a stream. Over time, these factors can significantly impair water quality and stream habitat.

The general trend for crop rotation throughout the Middle East Fork is a three year rotation of corn and soybeans. This rotation is preferable, as the high residue components left over from corn increase soil tilth and organic content. However, the low permeability and high moisture content of the Clermont soils leads many farmers to an alternative crop rotation of continuous soybean. Current and future commodity prices also influence crop rotation. Increased market demands for ethanol or soy will often determine which crop is planted. There is no irrigation utilized in the watershed, primarily due to a lack of adequate water resources.

As noted by the local NRCS and FSA agents, the majority of farmers report practicing no-till (NT) farming. NT farming preserves crop residue on the land and leaves the soil intact, which in turn, enhances nutrient content and reduces soil erosion. Research that examines the long-term effects of NT farming is needed to better understand how this practice effects the chemical, biological and physical attributes of the Clermont soils.

Local farmers also report the need to apply heavy doses of pesticides. The residues from chemicals that are used to control weeds, insects and fungi can impair water quality.

See Appendix C for a complete analysis on chemical use and tillage practices in the East Fork watershed.

Agriculture—Livestock Production

Table 2-4 lists estimates of the type and number of livestock in the Middle East Fork watershed. These are best estimates based on current information from large producers, plus USDA livestock program information from 1999 and 2002. Anybody familiar with agriculture in the area is aware of how quickly livestock demographics change based on family economics, markets, government programs, weather, and other factors. The trend is toward a few much larger livestock production facilities and away from the middle-sized operations of the recent past. Many farmers who produced some livestock in the 1980's and 90's have completely given up livestock production in favor of row-crop production. However, there still are quite a number of farmers that only have a few to a few dozen head, kept to take advantage of pasture or existing facilities.

There are a number of smaller livestock operations in the Middle East Fork that have resulted from the influx of hobby farmers into Clermont County. The individuals who run these operations sometimes lack the knowledge and experience needed for proper livestock management. As a result, inadequate animal housing and improper waste disposal can become significant issues, par-

Point Sources vs. Non-point Sources of Pollution

For ease of communication, potential pollution sources are classified as either "point sources" or "non-point sources." As the name implies, point sources are very concentrated sources of pollution, typically "end-of-pipe" discharges such as wastewater treatment plant effluent. Non-point source pollution is used to describe the many sources of pollution—such as runoff from agricultural fields, suburban lawns or parking lots—associated with stormwater runoff. Even though some areas—for example septic systems, chemical handling areas on farms, and feedlots—have a higher concentration of potential pollutants, they are still treated as non-point sources because the contaminants are typically carried to surface water in stormwater runoff.

ticularly in the smaller tributaries. Although these operations are small in scale, the collective impacts to the watershed can be detrimental. It is difficult to determine the exact number of these small-scale livestock operations; Clermont County does not require registration or licensing to raise livestock, and the majority of operators do not utilize local government programs. Thus, the table below is not a comprehensive report of livestock numbers in the watershed. Information obtained from local experts and residents reveal that the majority of operations in the watershed are new or existing horse farms. Although the table below only lists 40 individual horses, there are an estimated 30 horse farms in the watershed that house 1-5 horses per farm.

Over-grazing is a common issues for small livestock operations due to the limitation of space. The USDA recommends that livestock managers provide a minimum 2.5 acre area per animal unit (1,000 lbs). Most of the small operations also lack adequate feeding sites. Feeding sites should have gravel or concrete armors to prevent soil compaction, erosion and nutrient runoff.

Grazing estimates for the entire watershed could not be determined. The local NRCS and FSA agents indicate that small livestock operations do not represent a high percentage of land use in the Middle East Fork and thus, do not pose a significant threat to the watershed.

Livestock on pasture have the potential to contribute excess pollutant loadings to rivers, streams and lakes in the absence of appropriate management practices. The most important practice is to fence livestock out of streams, leaving a buffer area that settles out sediment and treats animal waste contained in the runoff. Local agents and

Watershed	*Livestock – Type and Number*					
	Hogs	*Cattle*	*Sheep & Goats*	Horses	*Mixed/ Unknown Type*	*Total*
Middle East Fork	250	223	14	40	20	547
TOTALS	250	223	14	40	20	547

Table 2-4. Estimated Numbers of Livestock in the Middle East Fork Watershed.
[Sources: USDA-FSA 1999 Small Hog Operation Payment Program (SHOP-II), USDA-FSA 2002 Livestock Compensation Program (LCP), livestock producers]

Livestock Type	**Size**	**Total Manure Production**	**Total Solids**	**BOD5**	**N**	**P_2O_5**	**K_2O**
	lb	**lb/day**	**lb/day**	**lb/day**	**lb/day**	**lb/day**	**lb/day**
Dairy Cow	1200	98	12.5	2.0	0.49	0.20	0.39
Beef Cattle	1000	60	6.9	1.6	0.34	0.25	0.29
Finish Hog	200	13	1.2	0.4	0.09	0.07	0.07
Sow w/litter	375	33	3.0	1.0	0.23	0.17	0.18
Sheep	100	4	1.0	0.1	0.05	0.02	0.04
Horse	1000	45	9.4	-	0.27	0.10	0.20

Table 2-5. Manure Production and Characteristics for Common Livestock Animals.

experts report that the majority of livestock operators in the Middle East Fork do not restrict access to streams.

Typical pollutants of concern from livestock production include suspended sediments and excess nutrients, resulting in the organic enrichment of surface waters. The decomposition of animal matter and excreta (as measured by BOD_5) depletes oxygen supplies in water bodies, which in extreme cases can be depleted to a point that aquatic life can no longer be sustained. Furthermore, the flushing of animal excreta into lakes and streams can potentially introduce pathogens (bacteria and viruses) into the water supply, and create a contact hazard for recreational users. Potential pollutants generated by different types of livestock are presented in Table 2-5.

Larger livestock facilities like feedlots and hog barns offer a broader set of challenges. At the production facility, animal wastes are highly concentrated. Great care must be taken to contain animal wastes until they can be applied properly to crop ground or composted. There are no large livestock facilities located in the Middle East Fork.

Horse Farms

Based on 2002 USDA-FSA livestock data 40 horses have been recorded within the Middle East Fork watershed region. This figure has undoubtedly increased as the number of 5-10 acre hobby farms has sky-rocketed, joining the few horse-based businesses (riding stables, breeders, etc.). Though most horse farms probably have little impact on water quality, the number of complaints and the sight of poorly maintained horse pastures reflects the limited knowledge that some new horse owners have about managing horses and their waste. Harsha Lake (also known as East Fork Lake) has a number of trails for horseback riding and many recreational riders travel from outside the area to use these services.

Quarries

Quarries represent a very small percentage of the area within the Middle East Fork watershed, but are worth noting because of the potential for non-point source pollution generated by excavating, moving and processing large quantities of sand and gravel if appropriate best management practices are not employed. There is only one quarry located within the Middle East Fork (see Figures 2-15 and 2-16) named Kipp's Gravel Company. It should be noted that no pollution has been associated with this quarry and the owner has supported the East Fork Watershed Collaborative on several occasions.

Household Sewage Treatment Systems

There are approximately 1,134 household sewage treatment systems (HSTS) - more commonly called septic systems or on-site wastewater treatment systems - in the Middle East Fork watershed (Figure 2-17). Nearly half of those systems are discharging systems (532). A percentage of all HSTS systems are not providing adequate wastewater treatment due to a variety of reasons that include poor design, poor construction, or installation of a system inappropriate for the soil type (e.g., leach field treatment system on Clermont soil). When a HSTS is not providing adequate treatment of wastewater, untreated sewage will collect on the ground surface or be carried directly to a ditch or stream.

Failing septic systems are a serious public health concern because of the potential that people will come into direct contact with untreated sewage in yards, ditches or streams. Stormwater runoff will carry the untreated sewage with its high concentration of nutrients into streams causing organic enrichment, excessive algal growth, and loss of dissolved oxygen. The flushing of untreated sewage into lakes and streams can potentially introduce pathogens (bacteria and viruses) into the water supply, and create a contact hazard for recreational users.

Some local estimates put the percentage of failing systems in the Middle East Fork at 25%. Many of these failing systems are simply older systems that were installed when our knowledge of HSTS was limited and before HSTS were adequately regulated. State and county laws and standards regulating the design and siting of on-site systems

Figure 2-15. Kipp's Gravel Company, Located Along the East Fork Mainstem.

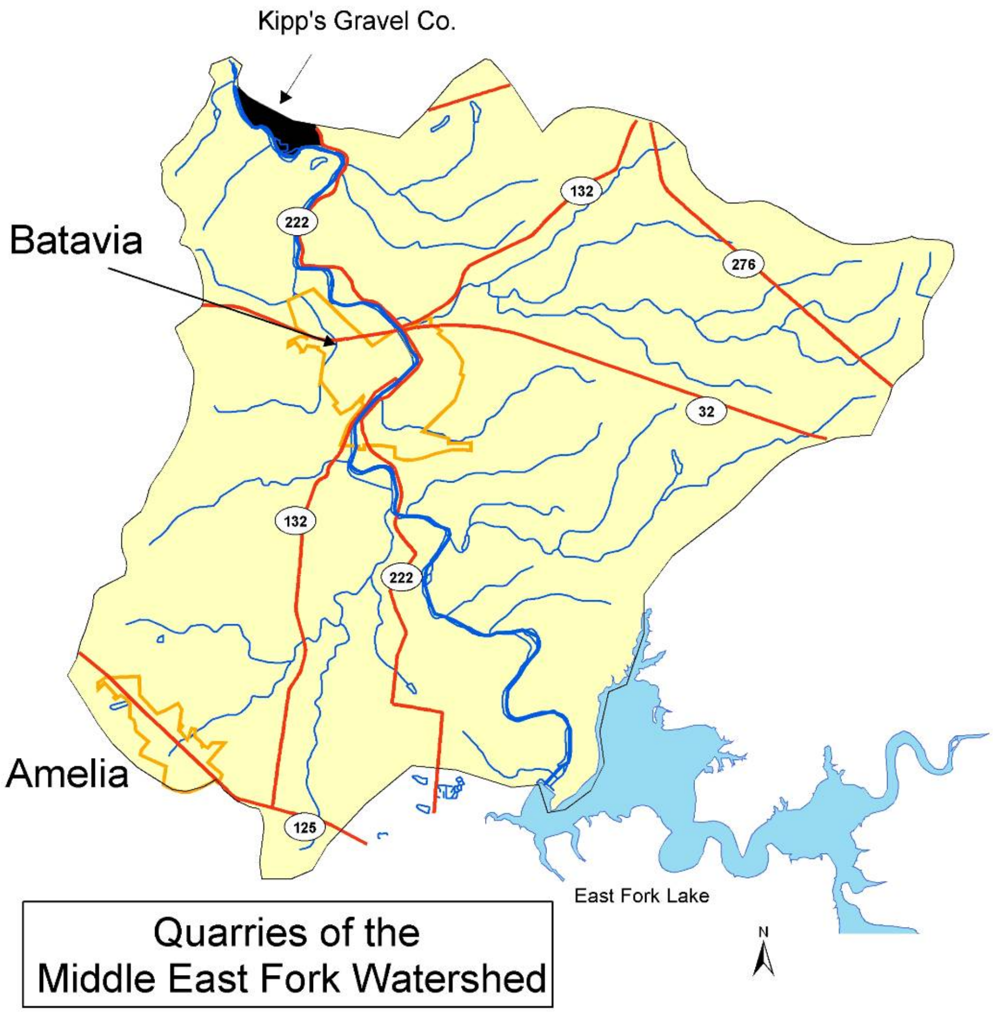


Figure 2-16. Rock Quarries in the Middle East Fork Watershed.

have been periodically updated to reflect our increased understanding of how these systems work (or don't work) in a given environment.

More specific information on septic systems may be found in the Home Sewage Treatment System Improvement Plan for Clermont County.

Urban Stormwater Runoff

Growth can be important to the vitality of neighborhoods and towns. It can have beneficial impacts for communities in terms of economics and community structure. However, growth and development that occur without environmental planning can create numerous challenges with stormwater management such as localized flooding and degraded stream quality. Urbanization increases the amount of impervious surfaces in the watershed, increases the runoff and pollutant loads, and potentially results in the impairment of streams. Based on 2002 land use data it has been estimated that the Middle East Fork watershed has 4% impervious surface coverage (see sidebar for watershed classifications based on percent of impervious cover.) In order for a balance to exist between growth and the environment, water quality concerns should be taken into consideration during the planning stages of development.

Phase II Storm Water Management Program

By March 2003, the Ohio Environmental Protection Agency (OEPA) required communities within urbanized areas to develop storm water management plans and to apply for coverage under the agency's Phase II storm water general permit. The goal of the Phase II program is to minimize the water quality problems that result from storm water runoff. These regulations affect 15 communities in Clermont County, including the County itself. The Clermont County Storm Water Department coordinates the implementation of the Clermont County Storm Water Management Plan (visit http://www.clermontstorm.net/ to review the plan) for 14 of the 15 Phase II communities in-

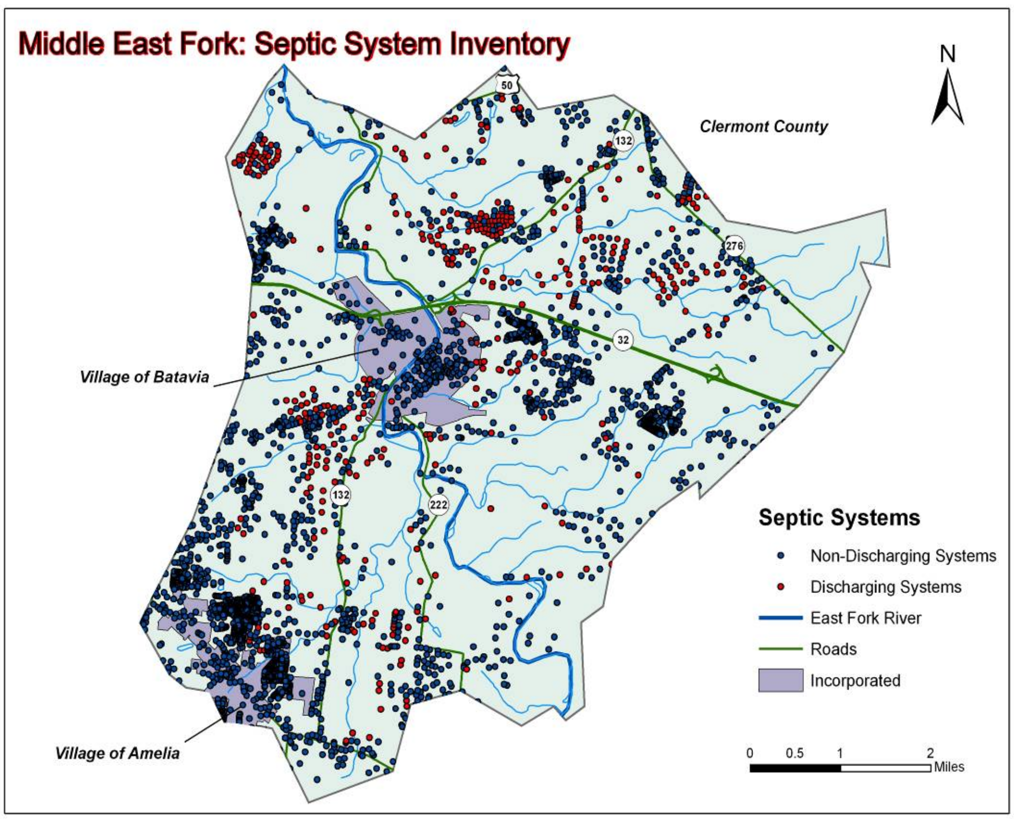


Figure 2-17. Inventory of Middle East Fork Household Sewage Treatment Systems (HSTS)

cluding all those in the Middle East Fork watershed..

Illicit Solid Waste Disposal

Impervious Area and Non-point Source Pollution

Higher amounts of impervious area are associated with commercial, industrial and even residential land uses. Impervious area is any surface which does not allow the infiltration of rainwater. Typical examples include roofs, road surfaces, parking lots, driveways and sidewalks. Studies have shown that as little as ten percent impervious cover in a watershed can be linked to stream degradation, with degradation becoming more severe as the impervious area increases. Watersheds are often classified based on their percent of impervious surfaces. Those with the least amount of impervious area tend to have the highest quality streams; and those with the most amount of impervious area typically have degraded conditions. The Center for Watershed Protection has classified watersheds with impervious cover of less than 10% as sensitive; 10-25% as degraded or impacted; greater than 25% as non-supporting of aquatic life.

Population growth and populations in general can also contribute to illicit solid waste disposal (e.g., litter and dumping). Many roadways are lined with litter and spatially dotted with illicit dumping sites. Unfortunately, many of these dumping sites are located adjacent to streams and within stream valleys. Because of the size and nature of illicit solid waste disposal it is difficult to calculate the enormity and location of illicit solid waste dispersal within a watershed. However, this does not mean such a problem can be ignored.

The East Fork Watershed Collaborative with direct assistance from local soil and water conservation districts and solid waste districts are working closely to address this issue. Numerous educa-

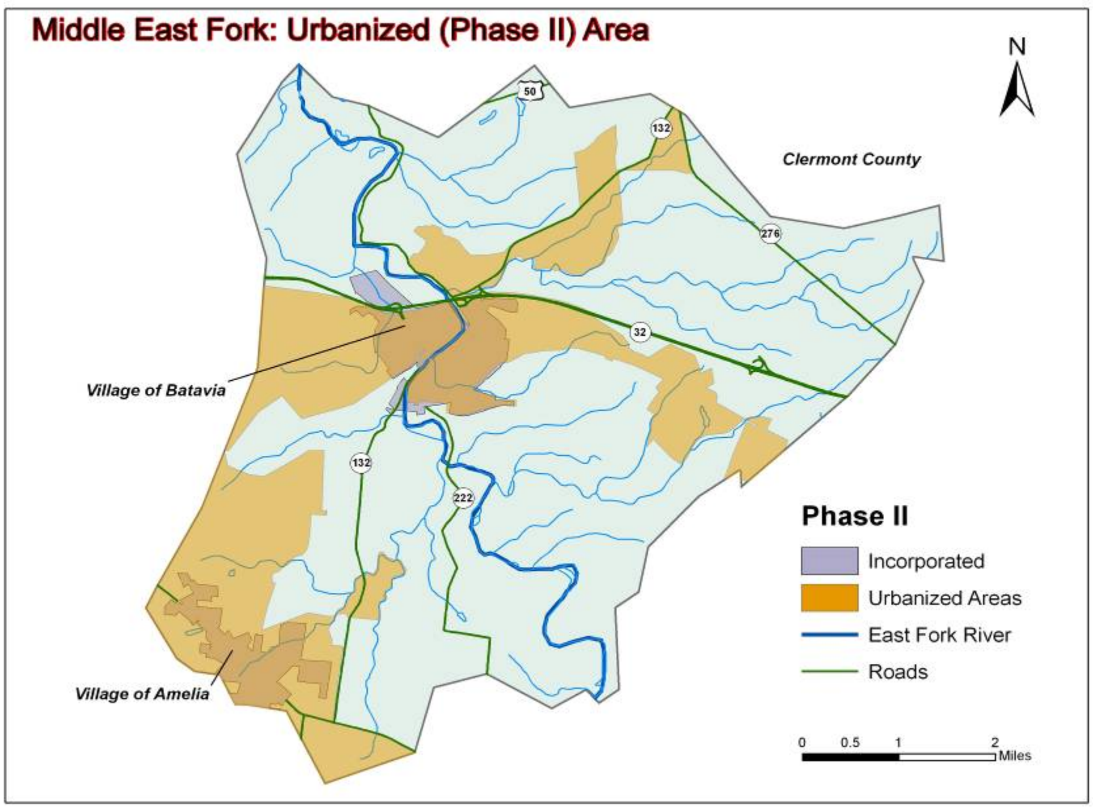


Figure 2-18. Middle East Fork Phase II Area.

tional programs have been established to spread awareness concerning litter prevention and the threat of illicit dumping in or near streams. Other programs have been established to engage the pubic in illicit solid waste removal.

East Fork River Sweep

To increase community awareness concerning litter and other debris that end up in our waterways, the East Fork Watershed Collaborative hosts a community clean up event each spring. The East Fork River Sweep began in 1992 and is held in various Clermont County sections of the East Fork watershed including; East Fork Lake, Stonelick Lake, Sycamore Park, Valley View Foundation, and along several miles of the East Fork mainstem. Each year hundreds of community volunteers participate to sweep over ten miles of streambank and shoreline within the East Fork watershed.

Potential Sources of Pollution — Point Source Inventory

Any time that contaminated or "waste" water is discharged from the end of a pipe, the pollution is termed "point source pollution." That water has typically received treatment to meet certain water quality standards that were designed to minimize its impact on the stream. Point sources have historically been one of the biggest culprits in stream pollution and degradation of water quality. In response to the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) was created to regulate the quality of water from factories and wastewater treatment facilities. Now those facilities have to conduct regular monitoring of pipe effluent and meet strict environmental standards. These discharge "hot spots" still have an impact on water quality because of water temperature, nutrients, metals, and other contaminants. This is especially true during summer low stream flow when the waste water discharges may make up a large percentage of stream flow.

Within the Middle East Fork watershed, there are two point-source dischargers permitted by Ohio EPA (see Figure 2-20). The permitted dischargers are:

- Batavia Sewage Treatment Plant (STP)
- Clermont County Middle East Fork STP

Figure 2-19. Group of Volunteers During the 15th Annual East Fork River Sweep.

Physical Stream Characteristics

The East Fork Watershed Collaborative currently has limited data on physical stream characteristics in the Middle East Fork watershed. Ohio EPA does not collect direct measures of stream morphology (see Figure 2-22), though some qualitative indicators are recorded as part of the Qualitative Habitat Evaluation Index (QHEI) outlined in Chapter 3. It should be noted that conducting a comprehensive inventory and detailed assessment of physical stream characteristics was identified as a priority during watershed planning for the Middle East Fork (see Chapters 4 & 5).

In 2001, Clermont County hired a consulting firm to conduct Rosgen Assessments (see Figure 2-21.) for all the streams in the County. These data, along with Clermont County's extensive GIS inventory, reveal that the East Fork Little Miami River (EFLMR) and tributaries within the Middle East Fork are in overall good condition (see Table 2-23). The dominant forest cover provides adequate riparian protection for the majority of the watershed. However, the expansion of urban and residential development is altering habitat and increasing storm water runoff, causing bank erosion, sediment deposition and entrenchment, particularly in the tributary systems (Tetra Tech, 2001).

Channelization is less pronounced in the Middle East Fork and the majority of streams in the watershed are natural. However, there are sections along the main stem and tributaries that have been modified. The main stem through Batavia has been channelized and has concrete banks upstream of Harsha Lake Dam. Some of the headwaters in agricultural fields have been turned into drainage ditches, while streams in residential areas have been placed into culverts and pipes.

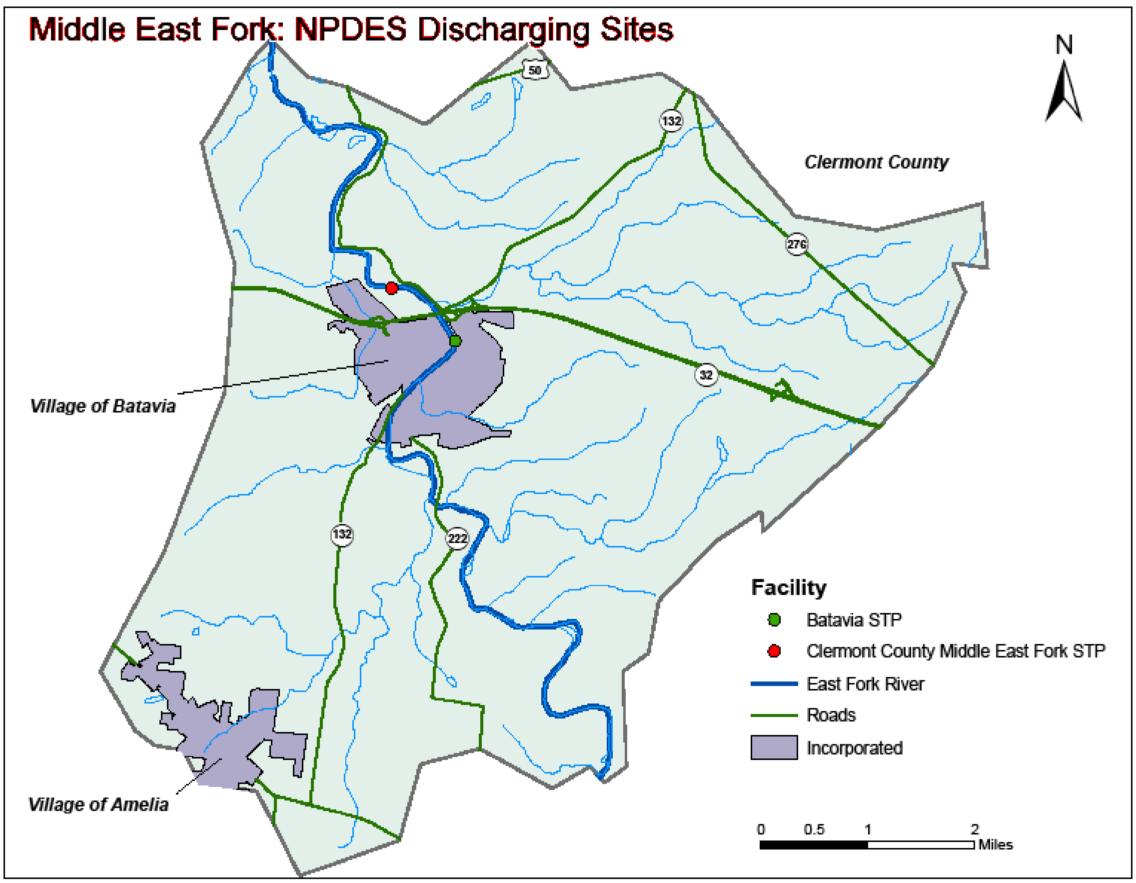


Figure 2-20. Location of NPDES Permitted Discharge Sites in the Middle East Fork Watershed.

Rosgen Stream Classification

The Rosgen stream classification system is a methodology used to describe streams and stream behavior based on basic hydrologic and morphological parameters (Rosgen, 1996). It uses a hierarchy of four assessment levels ranging from a broad geomorphic characterization (Level I) to detailed reach-specific hydraulic and sediment relationships (Level IV).

A Level I assessment classifies streams based on broad geomorphic stream characteristics. This characterization provides a framework for initial delineation of stream types and assists in setting priorities for more detailed assessments. A Level II (morphological) characterization provides a more detailed description based on field determined stream reach information. Level II information can be used as a basis for management interpretations. The third (Level III or "state") characterization level utilizes additional field observations and parameters to provide a description of stream conditions in terms of current and potential natural stability, and provides an assessment of the extent of departure from the natural potential. The fourth (Level IV or validation) assessment level is used to verify the assessment of stream condition, potential, and stability obtained in the Level III assessment. The Rosgen stream classification system has been found to provide a consistent methodology for comparing physical stream characteristics and stream behavior. In the Clermont County study, only Level I and Level II evaluations were performed.

Rosgen stream classifications are performed to:

•Obtain physical stream data using a consistent methodology
•Classify and compare streams based on observed data
•Identify impacted stream channels
•Correlate physical stream characteristics to water quality and biological data
•Quantify stream stability and erosion rates
•Describe stream behavior

The data obtained from the different assessment levels can be used to:

•Predict stream response to major storm events
•Predict stream erosion rates and sediment loads
•Predict stream response to road and bridge construction
•Predict stream response to urbanization practices (e.g., housing developments, construction sites)
•Provide guidance in performing stream restorations

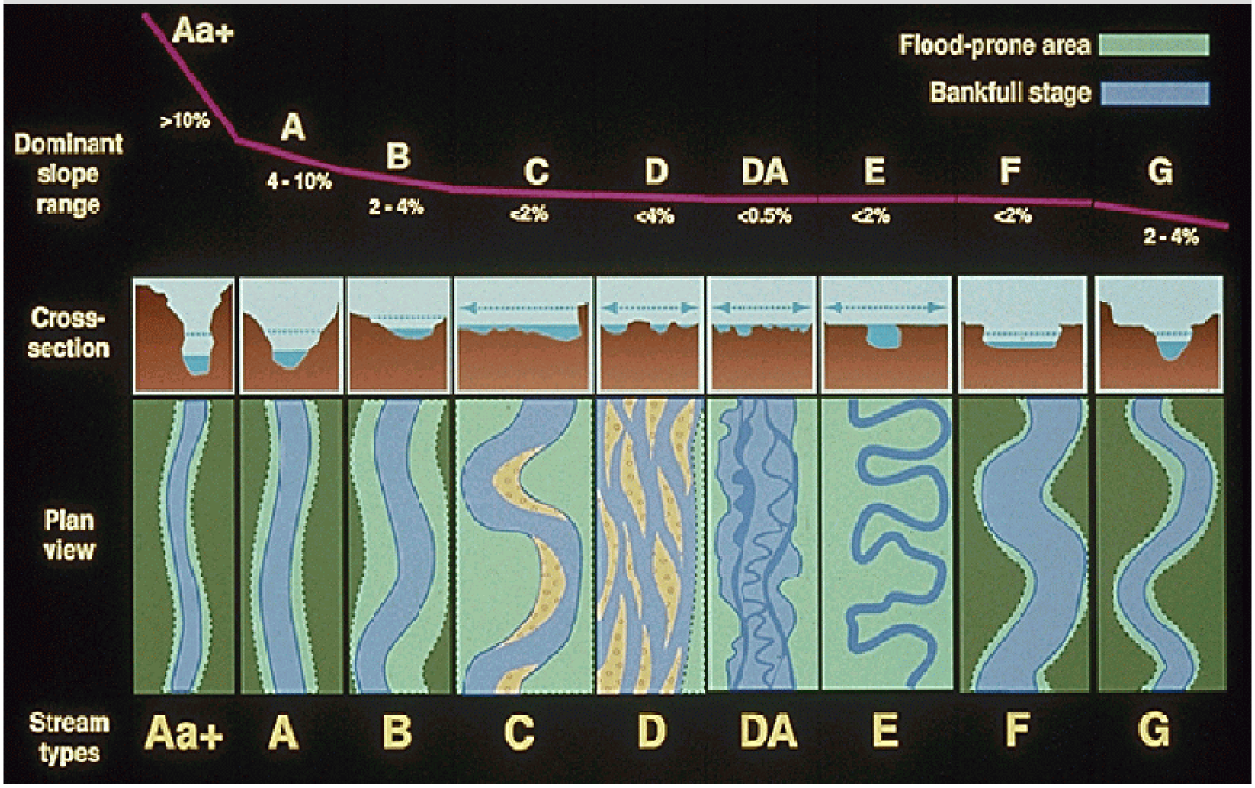


Figure 2-21. Rosgen Stream Classification System

Table 2-6. Rosgen analysis of Clermont County streams (Tetra Tech, 2001)

Rosgen Type	Slope Range	Sinuosity Range	Observed in Clermont County?	Notes
A	4- 10%	1.0-1.1	Yes	Steep, entrenched, cascading step-pool systems. High energy and debris transport in depositional soils, stable in bedrock and boulder channels. Typically stable.
Aa+	>10%	1.0-1.2	No	Very steep. Entrenched, cascading step-pool systems. Vertical steps with deep scour pools. This type includes waterfalls. Typically stable.
B	2 - 4%	>1.2	Yes	Moderately entrenched, step-pool systems, on moderate slops. Typically stable.
C	<2%	>1.4	Yes	Slightly entrenched, sinuous channels connected to floodplains. Riffle-pool morphology with point bar formation on inside bends. Typically stable.
D	<4%	N/A	No	Found in broad valleys, slightly entrenched, unstable multi-thread channel. High bedload. Typically very unstable.
DA	<0.5%	Highly Variable	No	Broad, low-gradient multi-thread channels typically draining extensive wetland complexes. Typically stable.
E	<2%	>1.5	Yes	Very sinuous, stable channels typically found in broad open fields. Riffle pool morphology. Narrow and deep (low width-depth ratio).
F	<2%	>1.4	Yes	Entrenched channel with high bank erosion rates. Low gradient with a riffle-pool or run-pool morphology. Typically unstable.
G	2 - 4%	>1.2	Yes	Gullies, typically with step-pool morphology. Moderate slopes. High bed load. Typically unstable.

Stream Morphology and Floodplain Access

More and more, scientists, engineers, environmental professionals and landowners are realizing the importance of stream channel form - also called stream morphology - to the maintenance of water quality. Channel form - channel size and shape, access or lack of access to a floodplain, presence of alternating pools and riffles - dictates how the stream handles both water and sediment. This is especially important during larger storm events when both flow and sediment loads are at their highest.

Streams that have the ability to overflow their banks during high flows dissipate much of the erosive energy of those high flows, and deposit some of the entrained sediment onto the floodplain. Conversely, highly entrenched streams (i.e., those that cannot access their floodplain during most high flows) contain and concentrate the erosive energy of high flows within the stream channel.

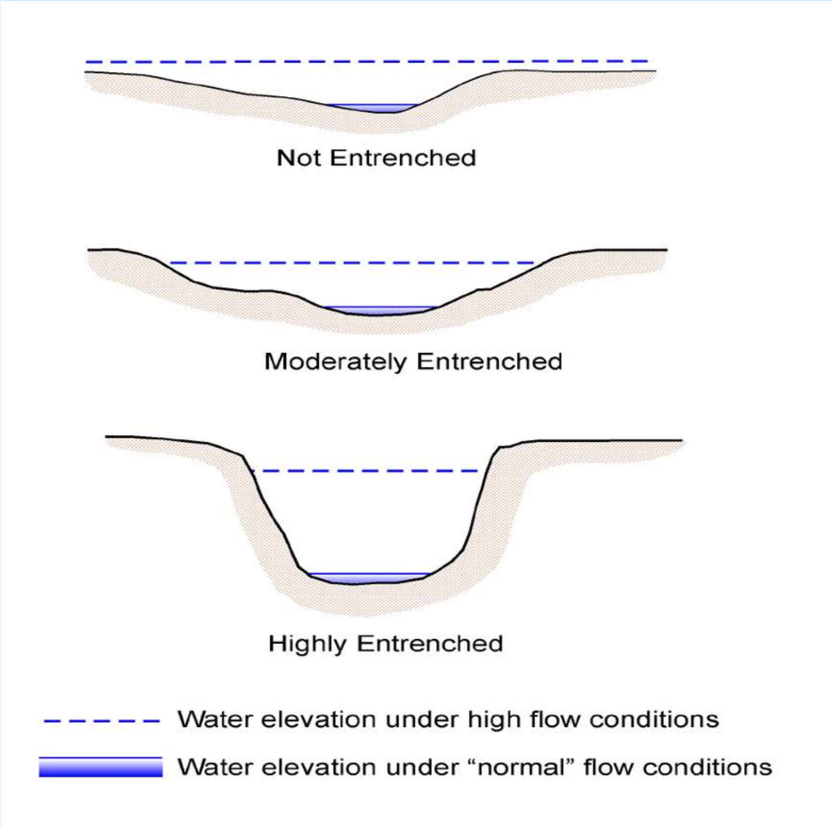


Figure 2-22. Entrenchment Describes a Stream’s Ability to Access its Floodplain Under High Flow Conditions.

In general, the main stem maintains access to its floodplain along its entire stretch, with the exception of a few locations (see figure 2.22). One such location is located downstream of Batavia along SR 222, where an unlicensed gravel mining operator filled in approximately 550 linear feet of floodplain. There is also a section of modified stream bank located immediately downstream of the Batavia low-head dam. In this section, approximately 600 linear feet of stream bank has been armored with concrete to prevent further erosion along the bank adjacent to State Route 132. No riparian levees have been observed in the watershed.

As the EFLMR meanders through pockets of development, the stream banks become steep and floodplain access is difficult to determine. Active floodplain on the main stem is most prominent in the downstream reaches, below Harsha Lake Dam and the Batavia low-head dam. Flooding is not a significant issue due to the controlled release from Harsha Lake Dam.

Stream flow in the Middle and lower sections of the East Fork main stem is controlled by the United States Army Corps of Engineers at Harsha Dam. A minimum of 30 cfs (cubic feet per second) is maintained. Little is known about how the continuous flow from Harsha Lake impacts sections of the EFLMR. The augmented flow from Harsha Lake and the dampened peak flows after rain events have the potential to alter habitat conditions and aquatic life. Future research is needed to determine if the EFLMR would bene fit from a modified flow release.

The main stem generally has sufficient riparian protection throughout its 11.7 mile stretch. Excellent riparian protection is found along the river

corridor within the East Fork State Park. High quality riparian habitat continues downstream, especially along the left descending bank (LDB) as the stream approaches Batavia Township. There is either limited or no riparian protection as the stream runs through Batavia. Other sections that lack adequate riparian projection, both up-stream and downstream of Batavia, occur where the stream is in close proximity to a roadway (SR 222, Roudebush Lane) or agricultural area. In total, there is approximately .35 non-contiguous miles along the main stem that lacks adequate riparian protection. Currently, there are no regulations in place to establish riparian corridor protection within the Middle East Fork.

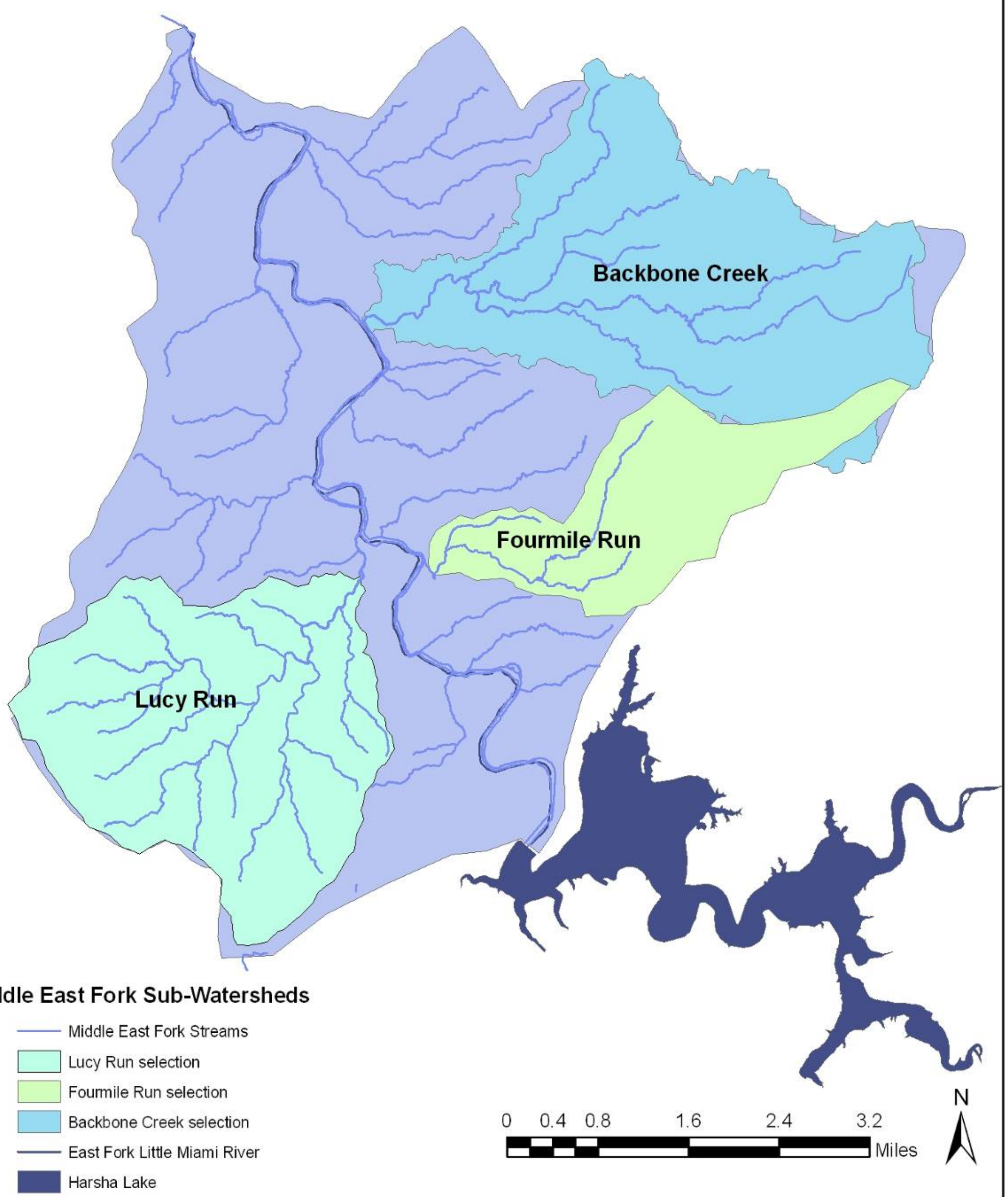
Middle East Fork Tributaries

As mentioned earlier, the tributary systems are in overall good condition (see Table 2-24, Figure 2-23.) The following paragraphs provide information on the physical characteristics of the tributaries according to data collected in the 2001 Rosgen Assessments.

Rosgen Assessment (Tetra Tech, 2001) Backbone Creek			
Stream	**Rosgen Classification Stream Type**	**Stream Length (ft)**	**Percent of Total**
Backbone Creek	B C F G	27,896 22,991 39,226 10,904	27.6% 22.8% 38.8% 10.8%
Fourmile Run	B C	12,737 17,754	41.8% 58.2%
Lucy Run	B C	110,036 11,760	90.3% 9.7%

Table 2-7. Rosgen Assessment for main tributaries in Middle East Fork

Figure 2-23. Middle East Fork Tributaries



Backbone Creek

The watershed of Backbone Creek is primarily agriculture and low-density residential (see Figure 2-24). The main stem from the mouth to Bauer Road, and the south branch that joins near Elmwood Drive, were classified as moderately entrenched, but stable B type streams. Two unnamed tributaries that enter the north side of the creek were categorized as F type streams. Nearly 40% of the stream length in this section is widely entrenched. The lateral extension of the channel and diminished riparian protection is causing high bank erosion rates. The main stem of Backbone Creek from Bauer Road to SR 276 was classified as a C stream and has good access to its floodplain, with a meandering pool/riffle channel. It should be noted that this section of the creek was identified as susceptible to changes in land use. In the early 2000's, sanitary sewers were extended along SR 32, leaving the area open to future development.

The headwaters of Backbone Creek were classified as G type gullies, with very narrow and entrenched channels and high erosion rates; these streams are currently utilized as agricultural ditches.

Changes along the Backbone Creek main stem since the Rosgen analysis include the construction of a storage facility near the mouth of the creek. All of the riparian vegetation was removed along the left descending bank during construction. Also, the construction of a conference center (RM .5) removed most of the riparian vegetation along the right descending bank. As a result, the right bank is eroding and encroaching upon the conference center's parking lot. In addition, gabion baskets have been placed across from the conference center on the left bank in an attempt to protect a sanitary sewer.

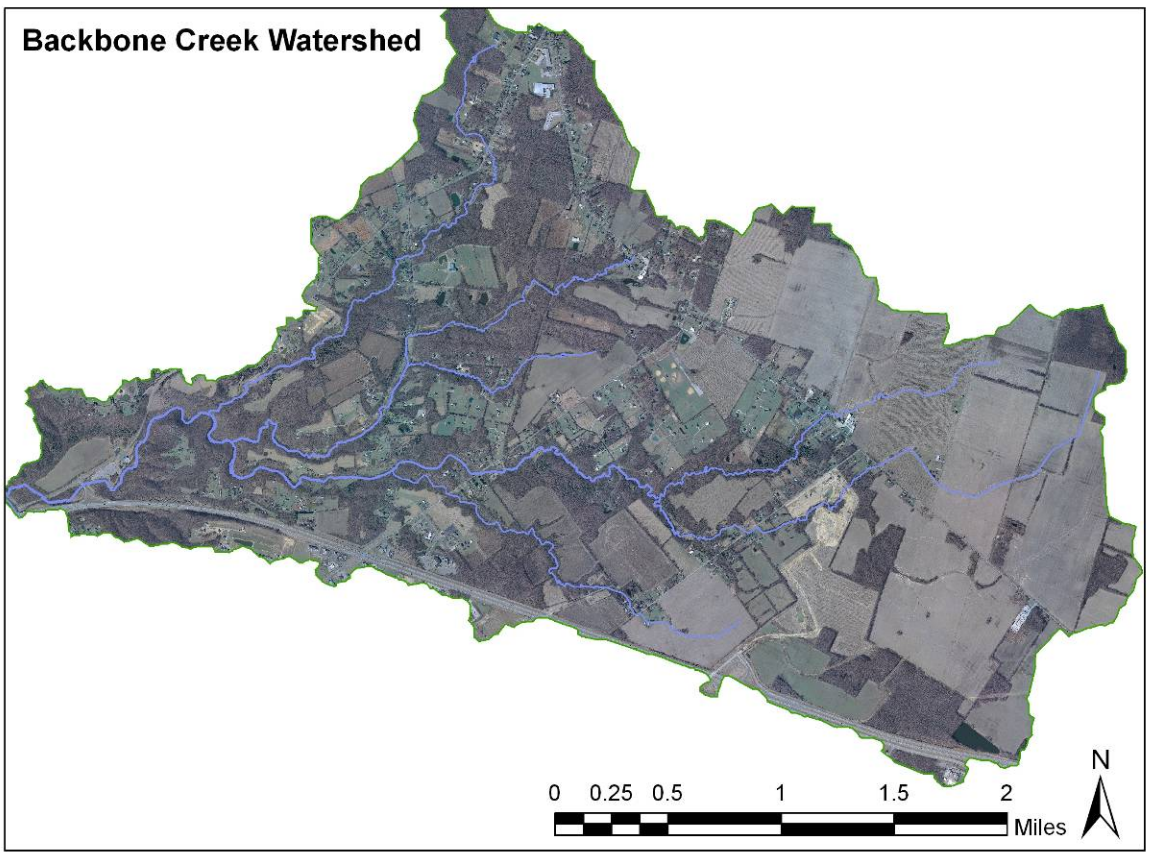


Figure 2-24. Aerial view of land use in Backbone Creek

Fourmile Run

The main stem and tributaries of Fourmile Run are all categorized as B and C type streams. The lower 1.3 miles of the main stem and a small unnamed tributary that comes from the north are categorized as B streams. The middle and upper reaches of Fourmile Run were classified as C type. These reaches are surrounded by forest and have excellent riparian protection (see Figure 2-25). The headwaters of Fourmile are surrounded by agricultural and light residential/industrial development. The Ford Transmission Plant and Batavia High School are located in the headwater assessment area.

The most significant land use changes following the Rosgen assessment includes the construction of the Elklick Run golf course. There was approximately 4,200 linear feet (.8 mi) of riparian vegetation removed during construction. Ohio EPA noted in their 1998 assessment that there were no erosion/sediment controls in place during construction, which contributed to heavy loadings of silts and sediments to the stream. In addition, approximately 1000 feet of the unnamed tributary has been piped. The golf course is currently experiencing problems with bank erosion.

Ohio EPA also noted that land development and suburbanization are contributing to erosion and runoff. There is approximately 175 acres of impervious surface in the watershed, which represents around 6% of the land use in the watershed. As mentioned earlier in this Chapter, watersheds that have impervious surface cover greater than 10% are classified as degraded or impacted.

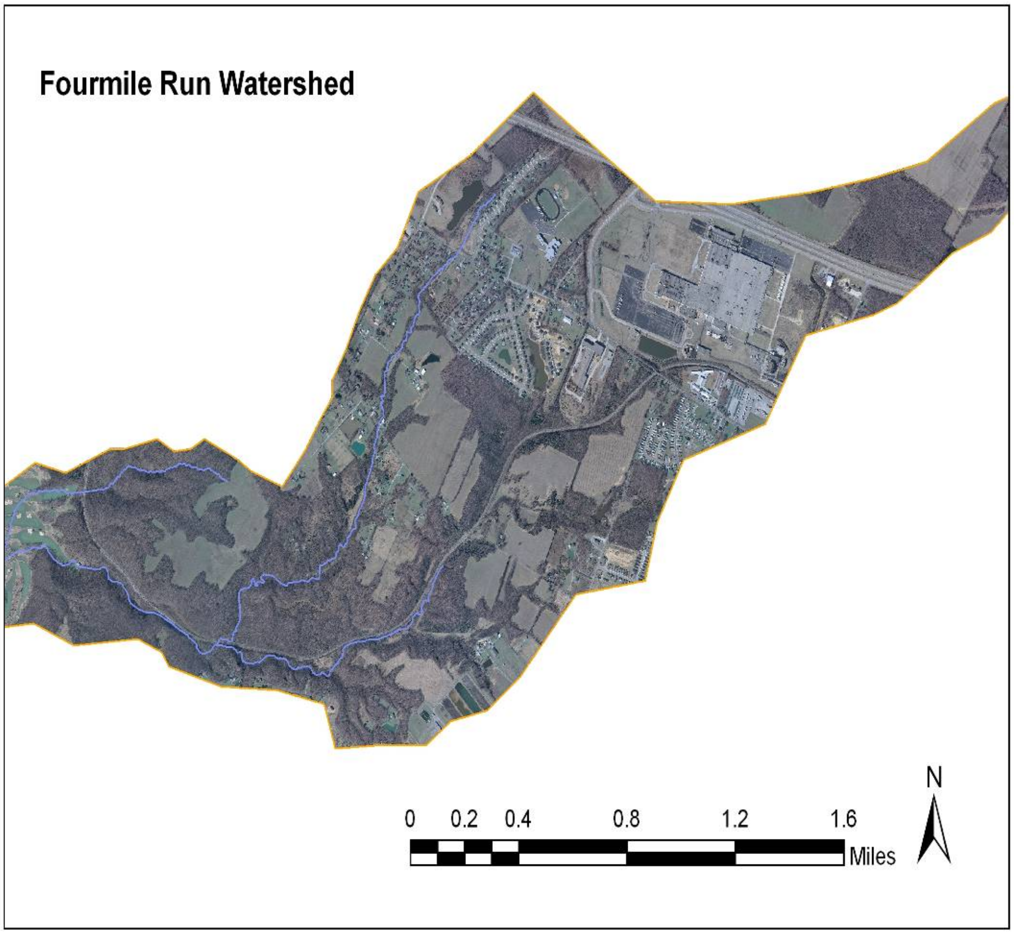


Figure 2-25: Aerial view of land use in Fourmile Run

Lucy Run

The Lucy Run watershed, located in the northeast of Amelia Village, consists mostly of forested and agricultural land (see Figure 2-26). Over 90 percent of Lucy Run was categorized as a B-type stream and the lower 2.2 miles classified as a C-type stream. There are good riparian zones in the lower stretch, with patchy riparian protection in the middle and upper sections. The headwaters are around the SR 125 (Ohio Pike) area, where the land use is rapidly changing from agricultural to residential/suburban. The area is rapidly developing and more than half of the watershed is zoned for residential and commercial development. Within the headwater assessment unit there is approximately 2,200 linear feet (.4 miles) of stream with no riparian protection.

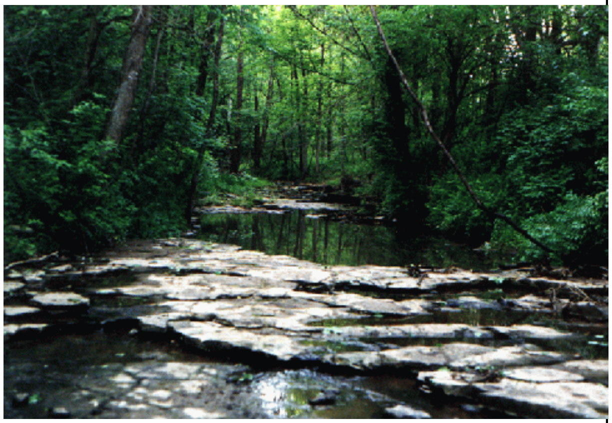


Figure 2-27. Lucy Run Sampling Site

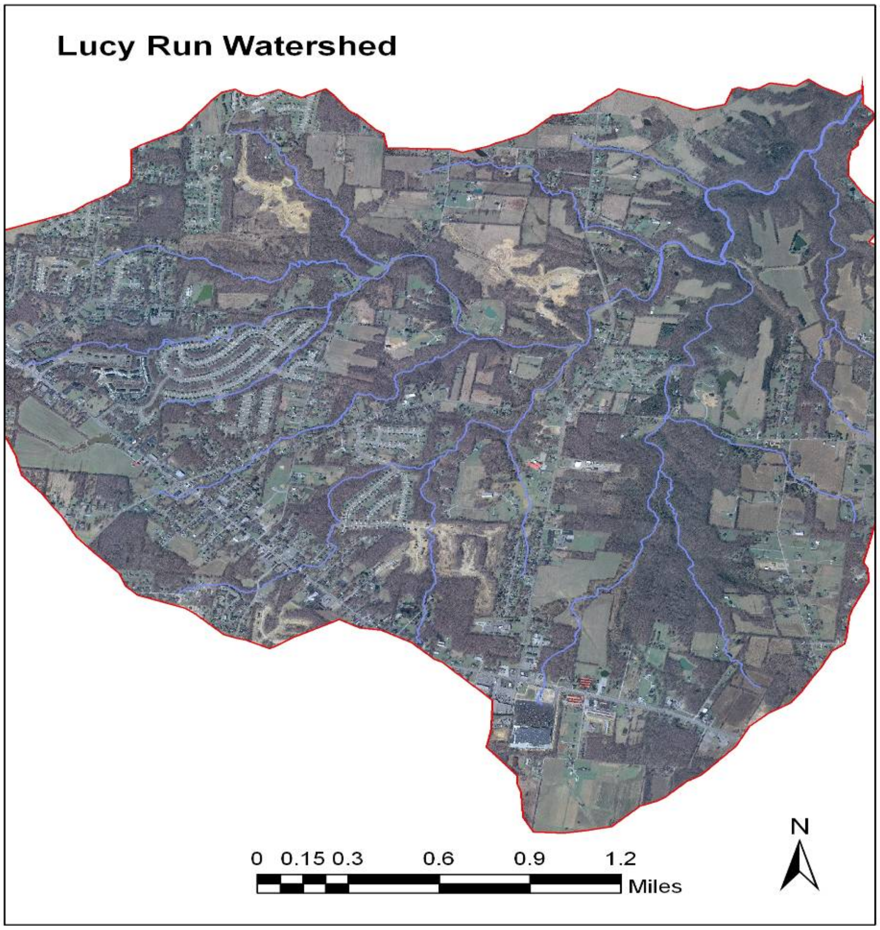


Figure 2-26: Aerial view of land use in Lucy Run

Community Resources

Clermont County has lead and participated in numerous regional and local utility, land use and transportation planning initiatives that include direct environmental influences to all or part of the Middle East Fork watershed. These initiatives include: 208 Water Quality Management Plan developed by Ohio-Kentucky-Indiana Council of Governments *(available through OKI Council of Governments)*; Eastern Corridor - Green Infrastructure Plan; Ohio 32 Corridor Vision Plan *(available through OKI Council of Governments)*; Clermont County Wastewater Master Plan *(available through Clermont County Serer and Water District)*; and Clermont County Thoroughfare Plan *(available through Clermont County Engineers Office).*

Each of these initiatives, developed with stakeholder input, over a long period of time, addresses the need and a vision for protecting water quality in the Middle East Fork watershed and beyond. Each initiative has considerable merit on an individual basis, but the consistent theme and broad stakeholder participation provides addition weight to the direction and value of a local vision. Notably, the Eastern Corridor - Green Infrastructure Plan included an advanced mitigation strategy that addressed the need to provide mitigation in advance of transportation projects for both primary and secondary impacts. The plans advance the concept of creating sustainable economic growth, balanced with sustainable environmental qualities, to insure a high quality of life for the community.

Batavia Lowhead Dam

The Batavia Lowhead Dam (Figure 2-21) is located within the Village of Batavia corporation limits and is maintained by the Village of Batavia. Discussions have begun between the Village and the Collaborative concerning the potential removal of the dam. The big questions to be asked and explored is whether or not the dam should be removed.

There are several known ecological factors as to why Lowhead dams should be removed (e.g., habitat improvement, fish passage, water quality), however many Lowhead dams are historical and retain a cultural significance to the surrounding community. For these reasons in-depth ecological studies will be performed (i.e., biocriteria, geomorphology, water chemistry) along with numerous public meetings to determine whether the dam should be removed or not.

Figure 2-27. Batavia Lowhead Dam

Cultural Resources

There is an abundance of cultural resources within the Middle East Fork watershed that increase the quality of life for residents in the region. Most of these resources highlight natural and historically significant areas in the watershed.

Recreation

There are many types of recreational opportunities for outdoor enthusiasts and a good supply of outdoor recreational amenities located in the Middle East Fork watershed. Hunting, fishing, canoeing, boating, hiking, bird watching, golfing, and biking are a few of the recreational opportunities found within the watershed. Canoeist and fisherman can access the East Fork mainstem at the Clermont County Park District Public Access located along State Route 222 behind the Clermont County Park District Maintenance building.

Figure 2-28. Picnic Shelter at Sycamore Park.

The quality of recreational opportunities within the East Fork watershed, and elsewhere, are inextricably linked to water quality and overall environmental quality. Often, forms of outdoor recreation are not compatible with the sustainability of the natural resources they utilize. It is the responsibility of planners, municipal leaders, and recreational organizations to ensure that activities in the East Fork watershed do not negatively impact the rich diversity of natural resources that draw tourism dollars into the region. Reversely, recreational opportunities offer residents a chance to enjoy the wonderful natural resources located within the watershed. Parks, preserves, and other recreational areas provide protection of open space within the watershed that help to ensure the future quality of the natural resources in the region.

Sycamore Park

Sycamore Park (Figure 2-23) is located one mile south of the Village of Batavia on State Route 132. Clermont County Park District's most popular park is a very picturesque 23 acre picnic site along the banks of the East Fork of the Little Miami River. Sycamore features three picnic shelters, an easy handicap accessible paved 5/8 mile hiking trail, tennis, volleyball and basketball courts, playfield, horseshoes and playground. Tall sycamore trees grace much of the park and wildflowers are excellent in the spring and summer months. Virginia Bluebells, Bloodroot, Wild Ginger, Trout Lilies, and False Rue Anenome are just a few of the abundant wildflowers that can be found along the wooded trails. A fun spot for kids and adults alike, Sycamore Park is an excellent location for reunions, company picnics and family get-togethers.

In the fall of 2008, the a local landowner donated 109 acres along SR 222 to the Park District. This land includes riverside frontage and is adjacent to Sycamore Park. The Park District hopes to open hiking trails in this new area.

Clermont Sportsman Club

The Clermont Sportsman Club is located in the Middle East Fork, adjacent to the mainstem below Sycamore Park. Although this is not an area formerly protected by the County or State, it is considered to be a protected recreational area.

Elk Run Golf Club

Only one golf course is located in the Middle East Fork watershed. It is located on Elklick Road south of Batavia off of State Route 222. Golf courses have been known to contribute to water quality impairments (i.e., herbicides, runoff), however the owners and operators of the Elk Run Golf Club have worked with the East Fork Watershed Collaborative on several occasions and no know water quality impairments have been associated with Fourmile Run, which traverse's the golf course.

History

The East Fork watershed region has a rich historical past. A number of Native American tribes called this area home, including the Shawnee, Miami, Delaware, Mingo, Ottawa, Cherokee, and Wyandot. The last Native American village in the area was located in Clermont County two miles south of Marathon in Jackson Township, along the mouth of Grassy Run on the East Fork of the Little Miami River. The Wyandot lived there until 1811. That location was the site of the largest frontier battle in Clermont County, the Battle of Grassy Run, where pioneer Simon Kenton clashed with Shawnee warrior, Tecumseh, on April 10, 1792.

The East Fork watershed region played an important role in the Underground Railroad due to its geography near the Ohio River across from the slave owning states of Kentucky and Virginia. A number of villages in Clermont County gave refuge to slaves, including Batavia, New Richmond, Moscow, Williamsburg and Bethel. Clermont County was one of the first places that slaves could rest and be safe.

The Middle East Fork is located entirely within Clermont County. Clermont County was established in 1800 and is the eighth oldest county in Ohio and the eleventh oldest county in the Northwest Territory. Historically, the land in the watershed was used primarily for agriculture. Over the last thirty years or so, changes in land use have occurred rapidly across the watershed, as residential, industrial, and commercial development is replacing land once used for crop production and pasture.

History of the Village of Batavia

The village of Batavia, third county seat of Clermont County, was built on land surveyed in May of 1788 for Francis Minnis, who was a captain in the American Revolution for seven years. A gold rush occurred in the Elklick valley in 1868, which resulted in the formation of the Batavia Gold Mining Company, which did not last for more than one year.

On July 14, 1863, Confederate cavalrymen under the command of Gen. John Hunt Morgan invaded the village. Some of the rebels spent the night in town, seeking fresh horses and food; others stole other valuable personal property. The Raiders were in Williamsburg on July 13 and also hit Owensville and Withamsville on the 14th.

For detailed maps of recreational, historical and other cultural resources in the East Fork watershed region visit the Ohio Valley Regional Development Commission web page at www.ovrdc.org.

Middle East Fork Watershed Action Plan

<u>Chapter Three</u>

Water Resource Quality

PO Box 549
Owensville, OH 45160
eastforkwatershed.org

CHAPTER 3: WATER RESOURCE QUALITY

The primary source of water quality data for the East Fork watershed is the Ohio EPA database developed over the last 30 years by the Ohio EPA Ecological Assessment Unit. The Ohio EPA data are supplemented here by monitoring data collected by the Clermont County Office of Environmental Quality.

Use Attainment Status

The 2006 Integrated Water Quality Monitoring and Assessment Report prepared by Ohio EPA provides the agency's most recent assessment of streams in the Middle East Fork subwatershed (defined in the report as the area draining to the East Fork downstream of the dam at Harsha Lake to the confluence of Stonelick Creek). The subwatershed encompasses approximately 11.7 miles of the East Fork Little Miami River (EFLM) and three major tributaries to the EFLM (Lucy Run, Fourmile Creek and Backbone Creek). While Lucy Run and Fourmile Creek have been assessed by both OEPA and Clermont County, neither organization has performed any water quality surveys in Backbone Creek or any of the smaller tributaries in this area of the East Fork Little Miami River. This chapter summarizes the status of these streams that have been assessed in terms of meeting their use designations (e.g., aquatic life use support, contact recreation use support) based on water quality and biological data collected by the state and the county.

The mainstem of the EFLM within the subwatershed has received an "Exceptional Warmwater Habitat" (EWH) aquatic life use designation, meaning this waterbody has the potential to support exceptional biological communities. All of the streams that serve as tributaries to the EFLM (with the exception of Dodson Creek in the headwaters subwatershed) have been designated by Ohio EPA as Warmwater Habitat (WWH) streams. Also, all streams have been designated for Primary Contact Recreation.

Ohio EPA's assessment of the Middle East Fork subwatershed is based on data last collected in 1998. A more specific assessment of individual streams within the subwatershed is provided in the agency's 2000 *Ohio Water Resources Inventory* 305(b) report. Based on these data, approximately 21.3 percent (2.5 river miles) of the EFLM was found to be in "Full, but Threatened" attainment of the river's use designation (EWH), while 40.2 percent (4.7 miles) was listed in "Partial" attainment (see Figure 3-1). The remaining 38.5 percent of the East Fork Little Miami River in this subwatershed (4.5 river miles) was determined to be in non-attainment of its EWH use designation. The Ohio EPA also assessed two tributary streams

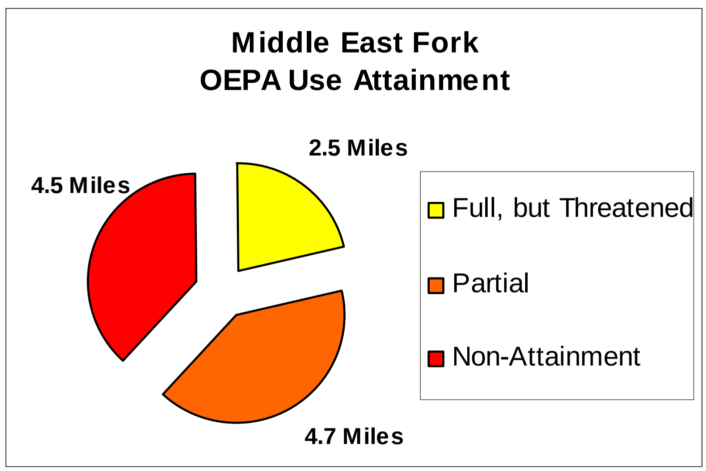


Figure 3-1. Middle East Fork OEPA Use Attainment.

in this section of the East Fork watershed in 1998 (Lucy Run and Fourmile Creek). The entire length of Lucy Run (2.4 river miles) was assessed at this time, with 41.7 percent (1.0 river miles) in "Full, but Threatened" status, another 41.7 percent (1.0 river miles) in "Partial" attainment, while the other 16.6 percent (0.4 river miles) did not support its WWH use designation. In Fourmile Run, the OEPA only assessed 1.3 of the 6.35 total river miles, and all of the segment assessed failed to meet its WWH use designation.

High concentrations of nutrients and flow altera-

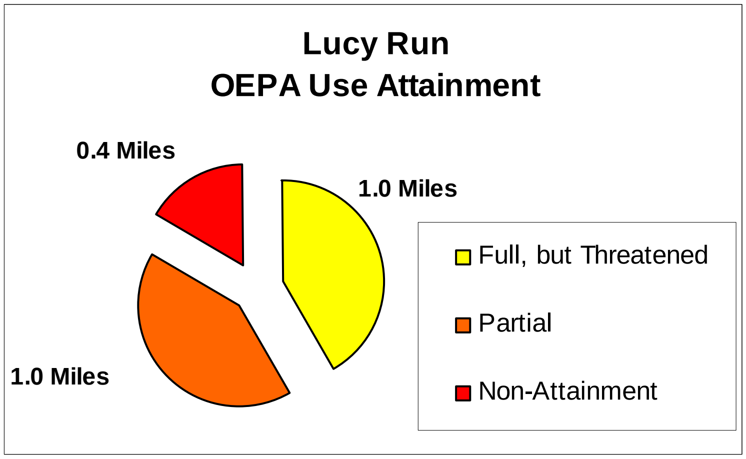


Figure 3-2. Lucy Run OEPA Use Attainment.

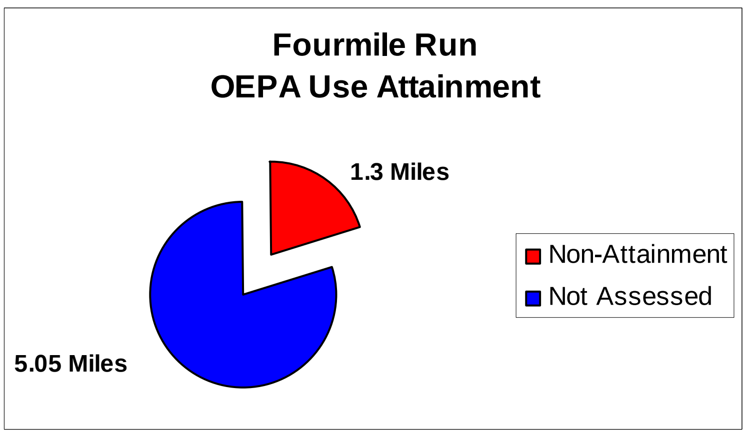


Figure 3-3. Fourmile Creek OEPA Use Attainment.

tion were listed as primary causes of impairment in the Midle East Fork segment of the EFLM. Nutrients, particularly nitrates, were elevated in this segment beginning downstream of the Middle East Fork Waste Water Treatment Plant (WWPT), although neither of the biological communities used to determine impairment (macroinvertebrates and fish) showed an immediate impact. There was a general increasing trend in phosphorus and nitrate concentrations downstream from the Batavia and Middle East Fork WWTPs. Flow alterations were associated with the U.S. Army Corps of Engineers' periodic discharges of water from the East Fork Lake dam.

According to OEPA's 2000 report, biological impairments in Lucy Run, a small, urbanized watershed, seems to be linked to habitat modifications in the upper watershed and general urban non-point source (NPS) runoff influences. Phosphorus concentrations were elevated above background levels, and aquatic life use was only attained at the lower reaches of the stream near the mouth. In Fourmile Run, the stream had a heavy bedload of silt and sand, presumably due to recent construction activities in the watershed, thus preventing it from attaining its WWH use designation.

According to Ohio EPA's 2006 Integrated Water Quality Monitoring and Assessment Report, the status of Primary Contact Recreation use support in this watershed is not impaired. However, there is a fish consumption advisory in effect for the entire length of the East Fork Little Miami River. The advisory recommends that fish consumption be limited to one meal per month for the following species: channel catfish, flathead catfish, rock bass, smallmouth bass and spotted bass. In general, the Ohio Department of Health advises that all persons limit consumption of sport fish caught in all Ohio waterbodies to one meal per week, unless there is a more restrictive advisory in place.

Sample Site Identification

River Miles are an easy and accurate way to identify sampling locations. River miles are measured in terms of distance (in tenths of a mile) from the stream "mouth." In Fourmile Run, river mile 0.0 (RM 0.0) would be the point where the creek enters the East Fork Little Miami River. River miles increase as you move upstream. Many of Clermont County's sampling sites are named using river miles. For example, EFRM75.3 indicates samples collected at East Fork River Mile 75.3.

Impairment:	*Nutrients*	*Siltation*	*Flow Alteration*	*Other Habitat Alteration*
Mainstem (EF Lake Dam to u/s Stonelick Creek)	X		X	
Lucy Run	X			X
Fourmile Run		X		X

Table 3-1. Causes of Impairment in Middle East Fork Sub-watershed.
Ohio EPA 2000 305(b) Report

Summary of Stream Conditions

Much of the data available in the Middle East Fork sub-watershed have been collected and compiled by Ohio EPA. Clermont County has also conducted a number of studies in the watershed, including biological surveys at three main stem sites beginning in 1997. The following paragraphs summarize the findings from these studies in the East Fork Little Miami River main stem downstream of the dam at East Fork Lake to upstream of Stonelick Creek.

Stream Biology - East Fork Main Stem

The Ohio Environmental Protection Agency (OEPA) conducted intensive biological surveys in the East Fork watershed in 1982 and more recently, in 1998. A smaller number of stations were also surveyed in 1993. A list of the Ohio EPA sampling stations, types of biological surveys conducted, and years conducted, is presented in Table 3-2.

During 1997, Clermont County conducted macroinvertebrate and fish surveys at three sites on the East Fork main stem, including river mile 15.6 at Sportsman's Park in Batavia, river mile 12.7 up-

Sampling Station	Location	1982	1993	1998
RM 9.1/9.2	Stonelick-Olive Branch Road Bridge	M	M/F	M/F
RM 10.1	@ Gravel Pit S. of Stonelick off SR 222	F		
RM 11.5	d/s Batavia Adjacent to SR 222	M		M/F
RM 12.2		F		
RM 12.4/12.5	d/s Middle East Fork (MEF) WWTP		F	M/F
RM 12.59	Mixing Zone MEF WWTP			F
RM 12.7	u/s MEF WWTP		M/F	M/F
RM 12.9		F		
RM 13.2/13.3	Batavia @ SR 32 Bridge	M		
RM 13.7	u/s Batavia WWTP	F		M
RM 14.7				F
RM 15.4/15.5	d/s Sportsman's Park, Batavia	M/F	M/F	M
RM 18.3				F
RM 19.6/19.7	u/s Batavia adjacent to Elklick Road	M		M

M = Macroinvertebrates
F = Fish

Table 3-2. Ohio EPA Biological Sampling Locations in the Middle East Fork Sub-watershed.

stream of the Middle East Fork WWTP, and river mile 9.1 at the Stonelick – Olive Branch Road bridge. In 1998, the county conducted macroinvertebrate and fish surveys at river mile 13.7, upstream of the Batavia WWTP, as well as RM 12.7 and RM 9.1. In 1999 and 2000, the county conducted macroinvertebrate and fish surveys at the river mile 11.3 adjacent to the property at 4610 SR 222, and the RM 13.7 and RM 9.1 locations. In 2001, only the RM 13.7 and RM 9.1 sites were sampled for macroinvertebrates and fish. In 2005, fish and macroinvertebrates were sampled at RM 12.7 and RM 11.3, above and below the Middle East Fork WWTP.

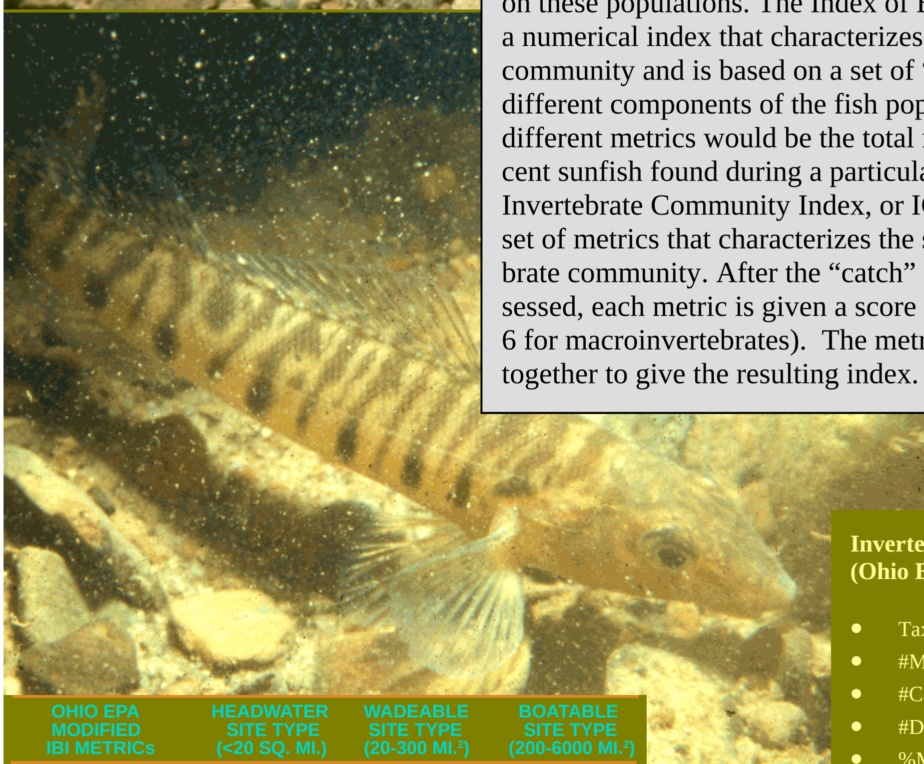
Fish Survey Results

Figure 3.4 shows the results of the OEPA fish surveys performed in the Middle East Fork Sub-watershed in 1982, 1993, and 1998. The average IBI score for 5 surveys conducted on the East Fork Little Miami River in 1982 is 44.6 $\pm$ 2.0, the average IBI score for the 4 East Fork surveys conducted in 1993 is 45.4 $\pm$ 1.0, and the average IBI score for the 8 sites surveyed in 1998 is 42.00 $\pm$ 4.72. If the site at RM 12.59, which is within the mixing zone of the MEF WWTP is removed from the data set, the 1998 average increases slightly to 42.5 $\pm$ 3.9. All of the sites in the Middle East Fork sub-watershed are designated as boat sampling sites. Therefore, the IBI criteria value is 48, and any site within four points of this value (i.e. IBI score of 44 or greater) is said to be meeting its EWH aquatic life use.

The 1982 data show no spatial trend (i.e. a linear line-of-best-fit has no slope). However, both the 1993 and 1998 data show a slightly decreasing trend in IBI scores from upstream to downstream. While the surveys each year resulted in several sites with IBI scores not significantly below the criteria value of 48, it should be noted that none of the sites in any year actually scored a 48 or higher, implying that there is room for improvement as far as water quality in this part of the East Fork Little Miami River. It should also be noted that, while the 1998 IBI score at RM 12.59 is significantly below the criteria value, this site is located within the mixing zone of the MEF WWTP, and

Biotic Indices

Ohio EPA has established biotic indices for both fish and macroinvertebrates as a means to directly assess any impacts on these populations. The Index of Biotic Integrity, or IBI, is a numerical index that characterizes the condition of the fish community and is based on a set of “metrics” that measure different components of the fish population. Examples of different metrics would be the total number of species or percent sunfish found during a particular survey. Likewise, the Invertebrate Community Index, or ICI, is based on a separate set of metrics that characterizes the stream’s macroinvertebrate community. After the “catch” for each survey is assessed, each metric is given a score (1, 3 or 5 for fish; 2, 4 or 6 for macroinvertebrates). The metric scores are then added together to give the resulting index.



OHIO EPA MODIFIED IBI METRICs	HEADWATER SITE TYPE (<20 SQ. MI.)	WADEABLE SITE TYPE (20-300 $MI.^2$)	BOATABLE SITE TYPE (200-6000 $MI.^2$)
1. Total Native Species	X	X	X
2. #Darter Species		X	
#Darters + Sculpins	X*		
%Round-bodied Suckers			X*
3. #Sunfish Species		X	X
#Headwater Species	X*		
%Pioneering Species	X*		
4. #Sucker Species		X	X
#Minnow Species	X*		
5. #Intolerant Species		X	X
#Sensitive Species	X*		
6. %Tolerant Species	X	X	X
7. %Omnivores	X	X	X
8. %Insectivores	X	X	X
9. %Top Carnivores		X	X
10. %Simple Lithophils	X*	X*	X*
11. %DELT Anomalies	X	X	X
12. Number of Individuals	X	X	X

* - Substitute for original IBI metric described by Karr (1981) and Fausch et al. (1984)

Invertebrate Community Index (Ohio EPA 1987; DeShon 1995)

- Taxa Richness
- #Mayfly taxa
- #Caddisfly taxa
- #Dipteran taxa
- %Mayflies
- %Caddisflies
- %Tanytarsini Midges
- %Other Diptera/Non-Insects
- %Tolerant taxa
- Qualitative EPT taxa
- 6,4,2,0 metric scoring categories.
- 0 to 60 scoring range.
- Calibrated on regional basis.
- Scoring adjustments needed for very low numbers of specific taxa

Biological Criteria

Ohio EPA has established separate biocriteria for five ecoregions in the State of Ohio. The East Fork Headwaters watershed lies within two of these ecoregions — the Eastern Corn Belt Plain and the Interior Plateau. Most of the East Fork Headwaters watershed is in the Interior Plateau ecoregion, including the East Fork Little Miami River downstream of river mile 66.7 and Dodson Creek. The East Fork upstream of river mile 66.7 and Turtle Creek are in the Eastern Corn Belt Plain ecoregion.

Ohio EPA has designated the upper 10 miles of the East Fork Little Miami River (river miles 75 to 85) as a "Warmwater Habitat" stream, while the remainder of the East Fork from river mile 75 to Harsha Lake in Clermont County has been categorized as having "exceptional warmwater habitat" (EWH). The EWH use designation means that this stretch of the East Fork is expected to have a more diverse and healthy biological community than a typical Ohio stream. As a result, the biological criteria established by Ohio EPA for the EWH section of East Fork are more stringent. To meet the EWH criteria in both the Eastern Corn Belt and Interior Plateau ecoregions, the Index of Biotic Integrity (IBI) scores used to rate the fish communities must be equal to or greater than 50 (or 48 for those sites fished using Ohio EPA's boat electrofishing protocol). The IBI criterion for the upper ten miles of the East Fork with the WWH designation is 40.

The health of the macroinvertebrate community is measured using Ohio EPA's Invertebrate Community Index, or ICI. For the EWH segment of the East Fork, ICI scores of 46 or greater must be attained to meet EPA's criterion, while ICI scores of 36 or greater will meet the WWH criterion. Scores within four index points of either IBI or ICI criteria are said to be in "non-significant departure" of the criteria, meaning that these streams would still be in compliance with Ohio's biological criteria. For example, EWH streams with IBI scores as low as 46 and ICI scores as low as 42 would still meet state standards.

Ohio Biological Criteria Adopted May 1990

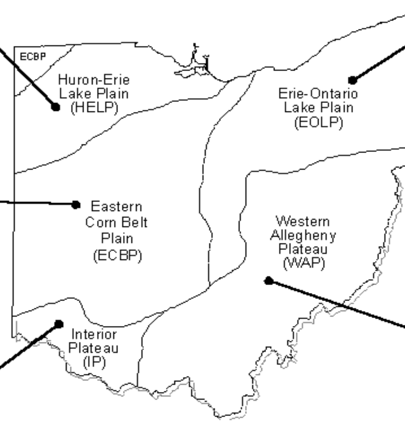
(OAC 3745-1-07; Table 7-14)

Huron Erie Lake Plain (HELP)

Use	Size	IBI	MIwb	ICI
WWH	H	28	NA	34
	W	32	7.3	34
	B	34	8.6	34
MWH-C	H	20	NA	22
	W	22	5.6	22
	B	20	5.7	22
MWH-I	B	30	5.7	NA

Erie Ontario Lake Plain (EOLP)

Use	Size	IBI	MIwb	ICI
WWH	H	40	NA	34
	W	38	7.9	34
	B	40	8.7	34
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-I	B	30	6.6	NA



Eastern Corn Belt Plains (ECBP)

Use	Size	IBI	MIwb	ICI
WWH	H	40	NA	36
	W	40	8.3	36
	B	42	8.5	36
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-I	B	30	6.6	NA

Western Allegheny Plateau (WAP)

Use	Size	IBI	MIwb	ICI
WWH	H	44	NA	34
	W	44	8.4	34
	B	40	8.6	34
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-A	H	24	NA	30
	W	24	5.5	30
	B	24	5.5	30
MWH-I	B	30	6.6	NA

Interior Plateau (IP)

Use	Size	IBI	MIwb	ICI
WWH	H	40	NA	30
	W	40	8.1	30
	B	38	8.7	30
MWH-C	H	24	NA	22
	W	24	6.2	22
	B	24	5.8	22
MWH-I	B	30	6.6	NA

Statewide Exceptional Criteria

Use	Size	IBI	MIwb	ICI
EWH	H	50	NA	46
	W	50	9.4	46
	B	48	9.6	46

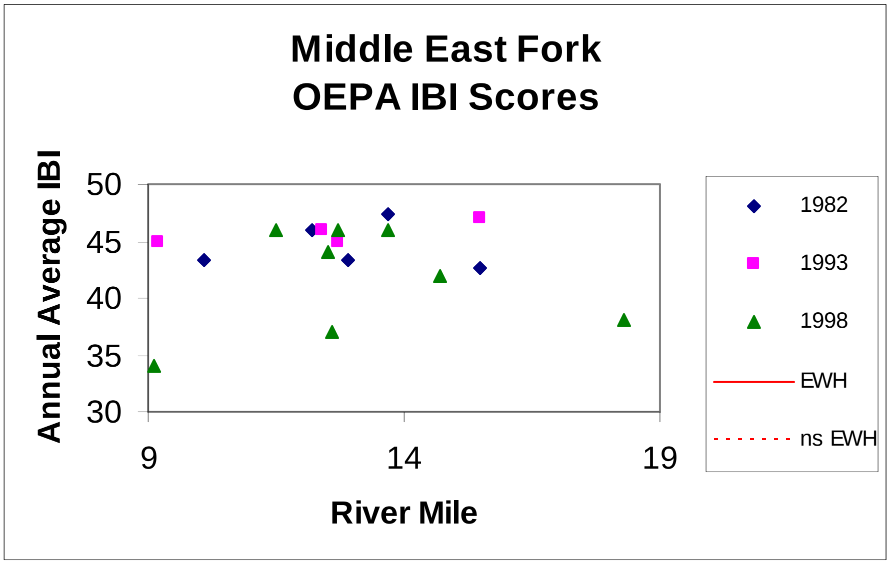


Figure 3-4. Ohio EPA Index of Biotic Integrity (IBI) Scores, Middle East Fork Sub-watershed (1982, 1993 and 1998).

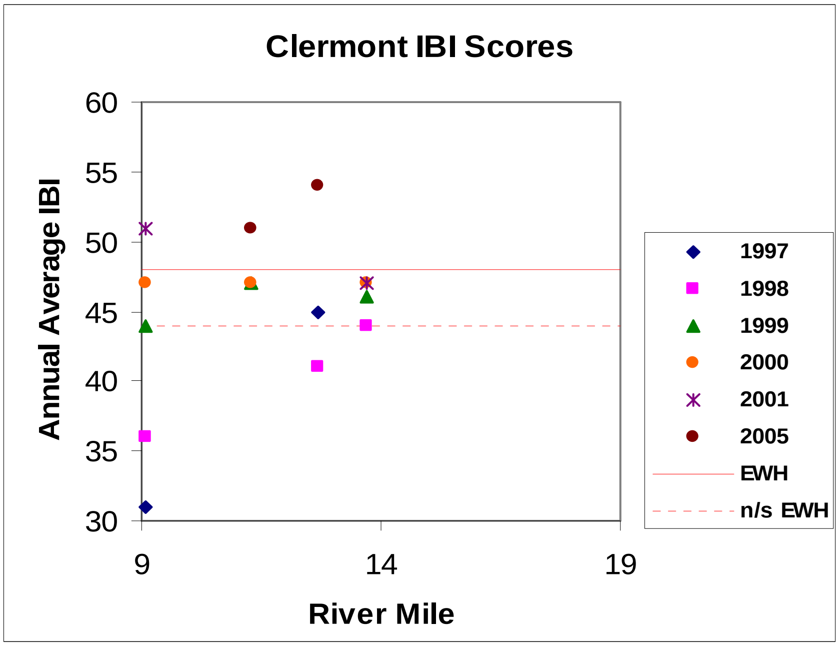


Figure 3-5. Clermont County Index of Biotic Integrity (IBI) Scores,

surveys performed immediately above (RM 12.7) and below (RM 12.5) this location both resulted in IBI scores of 46, not significantly different than the criteria value of 48.

In surveys conducted Clermont County from 1997 through 2005, IBI scores showed an improvement over time, with only the 1997 and 1998 surveys resulting in IBI scores significantly below the OEPA criteria value of 48. There is no consistent spatial trend in the Clermont County data. From 1997 to 1999, there was a slight downward trend in IBI scores moving upstream to downstream. In 2000, all three sampling locations had the same score, and in 2001, the downstream location had a higher IBI score than the upstream location. In 2005, the downstream sampling location scored slightly lower than the upstream locations, although both locations had IBI scores that exceeded the OEPA criteria value of 48. Based on results at RM 9.1 and 2005 data at RM 11.3 and 12.7, indications of significant improvement in IBI scores are represented.

DELT Anomalies

One of the metrics used in calculating the IBI is a rating based on the percentage of Deformities, Eroded fins, Lesions and Tumors – also known as DELT anomalies – found on fish. Metric scores of 1, 3 or 5 are given based on the percent DELT anomalies seen in a sample collection, with a score of 1 indicating more anomalies, and a score of 5 indicating few to none. The Ohio EPA's DELT scores from 1982 to 1998 show a drop in DELT scores between 1982 aqnd 1993, but a rebound in 1998 (Fig. 3-6). For surveys conducted in 1982, the average DELT score over 15 surveys was 3.5 ± 1.2. For the eight surveys conducted in 1993, the average DELT score was 2.6 ± 1.3. For the 15 surveys conducted in 1998, the average DELT score was 4.6 ± 0.8. There does not appear to be any consistent spatial trend in any of the sampling years.

The DELT scores associated with fish surveys performed by Clermont County from 1997 through 2005 are presented in Figure 3.7. Unlike the OEPA data, there are no obvious temporal or spatial trends in the data. In 1997, the average DELT score for 6 surveys was 3.3 ± 1.5. In 1998, the average DELT score for 6 surveys was 3.7 ± 1.6. In 1999, all 6 surveys had DELT scores of 5. In 2000, the average DELT score for six surveys was 2.2 ± 1.8, while all 4 surveys in 2001 had a DELT score of 3. In 2005, all 4 sampling events in the Middle East Fork resulted in a DELT score of 5.

Macroinvertebrate Survey Results

The Ohio EPA surveyed macroinvertebrates at five mainstem sites in the Middle East Fork subwatershed in 1982, four sites in 1993, and seven

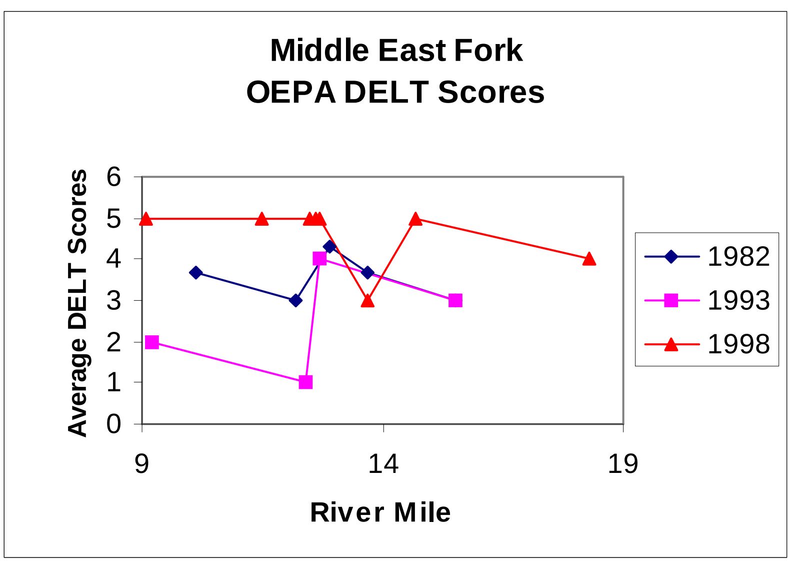


Figure 3-6. Middle East Fork OEPA DELT Scores.

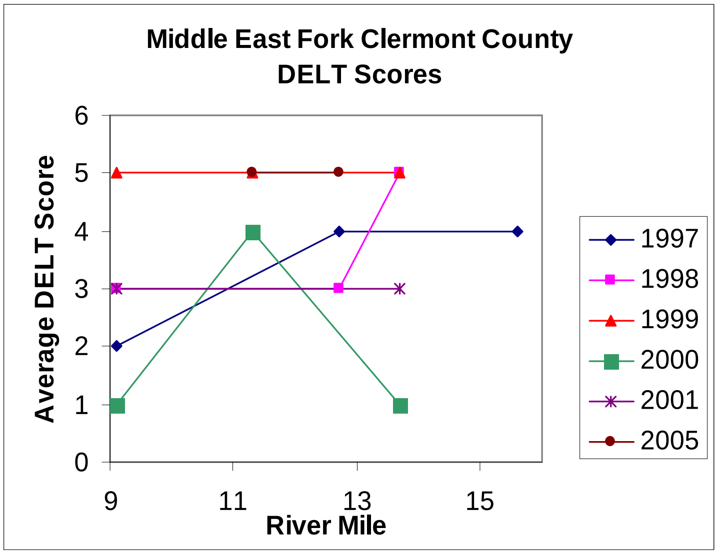


Figure 3-7. Middle East Fork Clermont County DELT Scores.

sites in 1998 (see Table 3-2). In 1982, one of the five sites surveyed (RM 19.6, just downstream of the Harsha Lake dam) received a low ICI score of 36, while the remaining four sites met or exceeded the EWH criteria value of 46. In 1993, all four sites met or exceeded the EWH criteria value, with three of the four sites (RM 9.2, RM 12.4 and RM 15.5) each scoring 54. Of the sites sampled in 1998, two failed to attain scores that were not significantly different than the EWH criteria value of 46, with RM 11.5 receiving a score of 36 and RM 19.7 scoring a 40. The site at RM 12.5 received a score of 44, not significantly different than the EWH criteria value, and the remaning four sites exceeding the EWH criteria value (Figure 3-8). there was not statistically significant difference in mean ICI scores from 1982 to 1998. There are no obvious spatial trends in the data, although both samples collected just downstream of the dam (RM 19.6 in 1982 and RM 19.7 in 1998) scored poorly (36 and 40, respectively).

Macroinvertebrate data from Clermont County for this section of the East Fork Little Miami River collected from 1997 through 2005 (Figure 3-9) show lower overall ICI scores, with ten of the sixteen samples scoring significantly less than the OEPA EWH criteria value of 46. As with the OEPA data, there are no obvious spatial trends in the Clermont County data. Unlike the OEPA, Clermont County sampling did not include the area just downsteam of the dam (located at RM 20.5), with the most upstream sample being collected at RM 15.6. It should be noted that, while the 2005 sampling resulted in the lowest ICI scores in the data set (28 at RM 11.3 and 32 at RM 12.7), an extreme meteorological event may have contributed to these low scores. Specifically, during the six-week colonization period for the artificial substrate samplers, the County experienced a heavy rain event (more than five inches in 24 hours) associated with the remnants of Hurricane Katrina. Flow changes of the magnitude associated with this type of rain event can have significant impacts on the colonization rates of artificial substrate samplers.

Stream Biology – Middle East Fork Tributaries

<u>Biological Communities</u>

Ohio EPA has also investigated the biological communities on two tributary streams to the Middle East Fork sub-watershed, Lucy Run and Fourmile Run. Fourmile Run was sampled at RM 0.2 in 1997, while Lucy Run was sampled at RM 0.2, RM 1.9 and RM 2.0 in 1998. Clermont County has also conducted biological surveys on Lucy Run at RM 0.3, sampling macroinvertebrates in 1996, and fish and macroinvertebrates in 1997, 1998 and 2000 (Table 3-4).

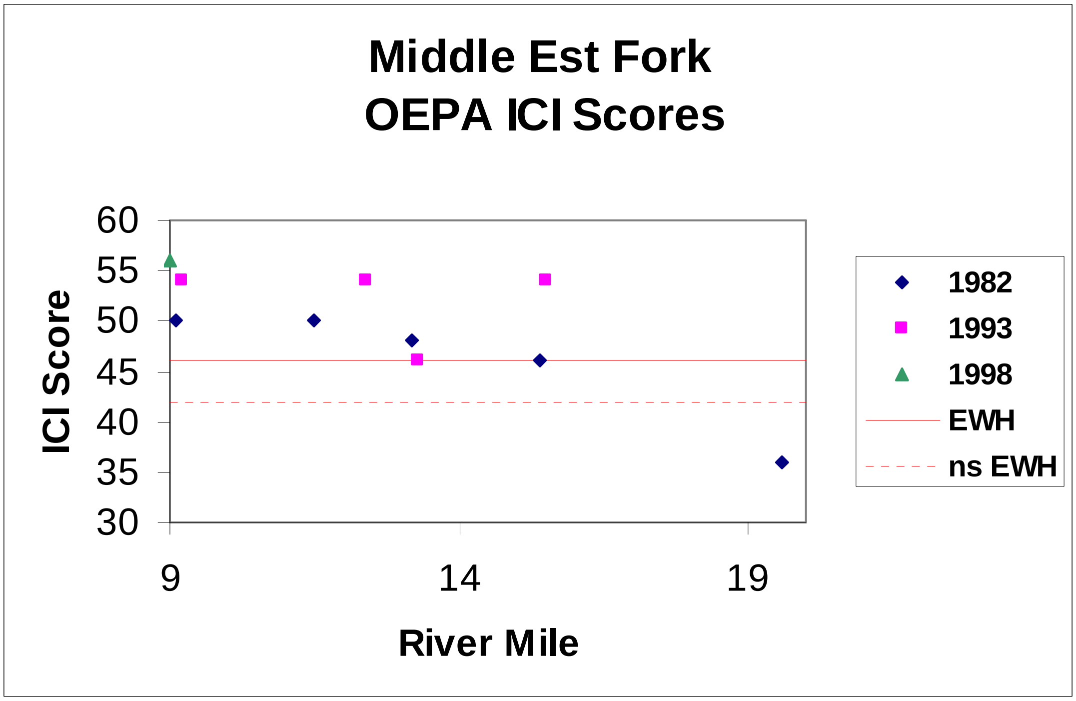


Figure 3-8. Ohio EPA Invertebrate Community Index (ICI) Scores, Middle East Fork Sub-watershed (1982, 1993 and 1998).

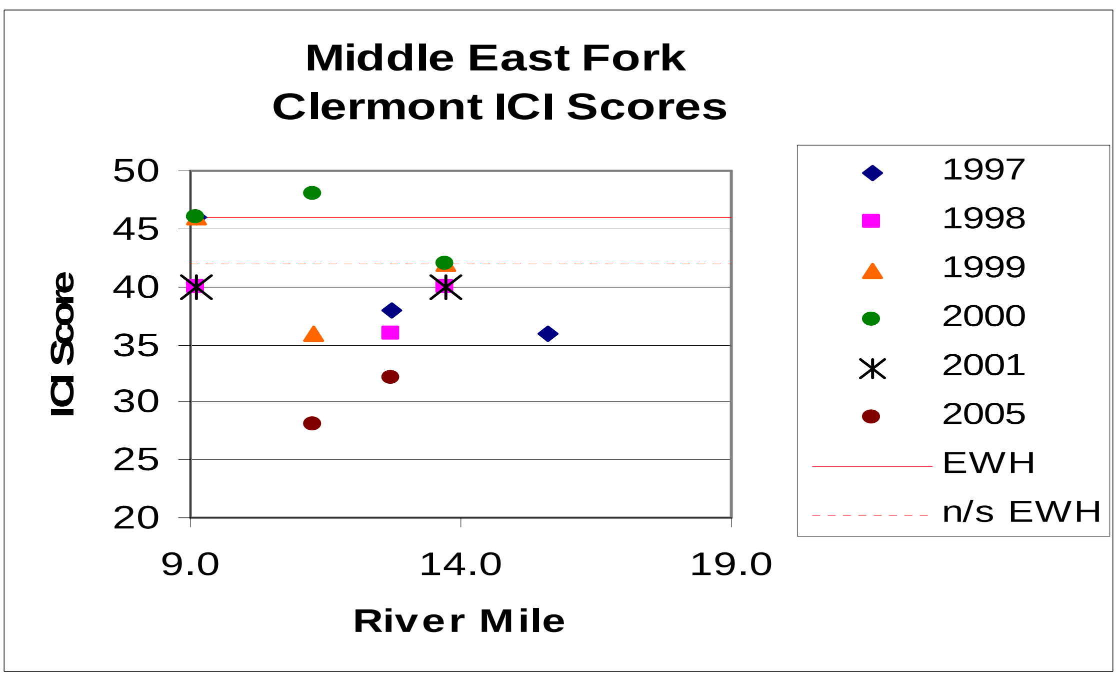


Figure 3-9. Clermont County Invertebrate Community Index (ICI) Scores, Middle East Fork Sub-watershed (1997 - 2001).

TRIBUTARY	RM	YEAR	QCTV	IBI	QHEI	DELT
Lucy Run	0.2	1998	39.3	50	60.0	5
Lucy Run	1.9	1998	35.3	35	62.0	5
Lucy Run	2.0	1998	Not Sampled	26	45.5	5
Fourmile Run	0.3	1997	39.8	34	70.0	5

At or above OEPA Criteria Value

Below OEPA Criteria Value

Streams were sampled for macroinvertebrates, but data were insufficient to calculate an ICI Score. QCTV scores based on qualitative sampling.

Table 3-3. Ohio EPA Biology Data for Middle East Fork Sub-watershed Tributaries.

TRIBUTARY	RM	YEAR	ICI	QCTV	IBI	QHEI	DELT
Lucy Run	0.3	1996	18				
Lucy Run	0.3	1997		40.0	42		5
Lucy Run	0.3	1998		32.7	51		4
Lucy Run	0.3	2000		39.0	55	69.0	5

At or above OEPA Criteria Value

Below OEPA Criteria Value

For all years except 1996, stream was sampled for macroinvertebrates, but data were insufficient to calculate an ICI Score. QCTV scores based on qualitative sampling.

Table 3-4. Clermont County Biology Data for Middle East Fork Sub-watershed Tributaries.

Ohio EPA has designated the two tributaries to the EFLM River in the Middle East Fork sub-watershed as warmwater habitat (WWH) streams. The fish (IBI) criterion for WWH headwater/ wadable streams is 40. Streams in the Middle East Fork sub-watershed must attain an ICI of 30 to meet the WWH use designation. Any score within 4 points of the criteria value is not significantly different from the criteria value. Therefore, in order to meet use attainment criteria, IBI scores must be greater than or equal to 36, and ICI scores must be greater than or equal to 26.

The OEPA data presented in Table 3.3 show a very good IBI score of 50 at the Lucy Run RM 0.2 sampling location, but poor IBI scores at the upstream sites, and at Fourmile Run RM 0.3. It should be noted that the drainage area at Lucy Run RM 1.9 was only 3.6 square miles, 3.5 square miles at Lucy Run RM 2.0, and 3.5 square miles at Fourmile Run RM 0.3. Such small headwater areas may be incapable of supporting fish communities capable of scoring well on the IBI due to a lack of multiple, diverse habitats. Clermont County fish surveys performed at Lucy Run RM 0.3 in 1997, 1998 and 2000 all resulted in IBI scores that exceeded the WWH criteria value of 40 (Table 3-4).

As seen from an examination of the ICI columns in Tables 3.3 and 3.4, only one sampling event, performed by Clermont County at Lucy Run RM 0.2 in 1996, resulted in an ICI score. For all other sampling events, no ICI score could be calculated. This is most often due to the fact that, for most of these small tributary streams, summer flows are too low to allow the prolonged deployment of the artificial substrates used for ICI sampling. As a result, the streams are usually sampled using kick net sampling, the results of which can only be used to make qualitative assessments of macroinvertebrate community health. For these streams, OEPA has developed a Qualitative Community Tolerance Value (QCTV) rating system, which assesses the environmental tolerance or sensitivity of the macroinvertebrate community using tolerance values that are assigned to each taxon. The range of tolerance values, 0 = poor to 60 = excellent, is the same as the ICI scoring range. Macroinvertebrate communities in the Interior Plateau ecoregion, which includes the Middle East Fork, are considered to be in excellent or good condition if their QCTV scores are at or above 39.20, while communities scoring below 34.85 are considered to be in the fair to poor range. QCTV values that clearly fall between these two values are considered to be in indeterminate.

As seen from Table 3-3, the Lucy Run site at RM 0.2 had a QCTV value of 39.3, just above the threshold for “Good-Excellent” sites, while the Lucy Run RM 1.9 site had a QCTV score of 35.3, in the “indeterminate” range. The site at RM 0.3 on Fourmile Run had a QCTV value of 39.8, also in the “Good-Excellent” range. Clermont County assessments at Lucy Run RM 0.3 resulted in an ICI value of 18 in 1996, well below the WWH criteria value, and QCTV scores of 40.0 (Good-Excellent) in 1997, 32.7 (Fair-Poor) in 1998, and 39.0 (indeterminate) in 2000.

Habitat Evaluations

Ohio EPA field crews typically assess the quality of stream habitat when they conduct fish or macroinvertebrate surveys using the state’s Qualitative Habitat Evaluation Index (see Sidebar). Since 1982, EPA crews completed 16 habitat surveys in the Middle East sub-watershed, including eight on the East Fork main stem between river miles 9.1 and 18.3 (Table 3-5), and four tributary surveys. Clermont County also performed a habitat assessment as part of its survey on Lucy Run in 2000.

In general, QHEI scores were very good in the main stem East Fork, with scores ranging between 78.5 and 91.0. Scores from the most recent survey in 1998 were higher (83.5 – 91.0) than scores from earlier surveys in 1993 (83.5 – 89) and the single survey performed in 1982 (78.5).

In addition to the East Fork main stem surveys, Ohio EPA also evaluated the habitat in Lucy Run and Fourmile Run. As Table 3-3 indicates, the lowest QHEI scores was a 45.5 at River Mile 2.0 of Lucy Run. Downstream sites at RM 1.9 and RM 0.2 scored higher (62.0 and 60.0 respectively), and the single site on Fourmile Run a RM 0.3 scored a very respectable 70. The Lucy Run

River	River Mile	Year Surveyed	QHEI Score
East Fork Little Miami	9.1	1998	90.0
East Fork Little Miami	9.2	1993	89.0
East Fork Little Miami	11.5	1998	83.5
East Fork Little Miami	12.4	1993	87.0
East Fork Little Miami	12.5	1998	91.0
East Fork Little Miami	12.7	1993	83.5
East Fork Little Miami	12.7	1998	91.0
East Fork Little Miami	13.7	1998	90.5
East Fork Little Miami	14.7	1998	93.0
East Fork Little Miami	15.5	1982	78.5
East Fork Little Miami	15.5	1993	86.0
East Fork Little Miami	18.3	1998	89.5

Table 3-5. Ohio EPA QHEI Scores, East Fork Little Miami River, River Miles 9.1 to 18.3.

Qualitative Habitat Evaluation Index

The Qualitative Habitat Evaluation Index, or QHEI, is a physical habitat index designed to provide a quantified evaluation of stream characteristics that are important to fish and macroinvertebrates. The QHEI is composed of six separate measures, or metrics, each of which are scored individually and then summed to provide the total QHEI score. The metrics include: substrate type and quality; presence of different types of instream cover and the overall amount of cover available; channel morphology; the quality of the riparian buffer zone and extent of bank erosion; the quality of the pool, glide and/or riffle-run habitats; and stream gradient (the elevation drop through the sampling area). The maximum QHEI score possible is 100. Streams with a QHEI of 80 or greater typically have a very good chance to meet Exceptional Warmwater Habitat (EWH) criteria. If QHEI scores are less than 60, it is generally difficult for streams to achieve the Warmwater Habitat (WWH) criteria.

Reference:
Rankin, E.T. 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods and Application. Ohio EPA, Columbus, OH.

Website:
http://www.epa.state.oh.us/dsw/bioassess/ohstrat.html

site at RM 0.3 surveys by Clermont County in 2000 scored a 69.0 (Table 3-4).

As expected, IBI scores and QHEI scores tended to follow each other relatively closely, i.e. the better the habitat, the better the fish community (Figure 3-10). Exceptions include RM 1.9 of Lucy Run surveyed by OEPA in 1998, when the survey resulted in a low IBI score of 35, despite a good QHEI score of 62.0, and RM 0.3 of Fourmile Run, surveyed by OEPA in 1997, when survey results indicated an IBI of 34 despite a QHEI score of 70.0. Discrepancies of this nature indicate situations in which the observed impairment in biological community structure was likely due factors other physical habitat alteration.

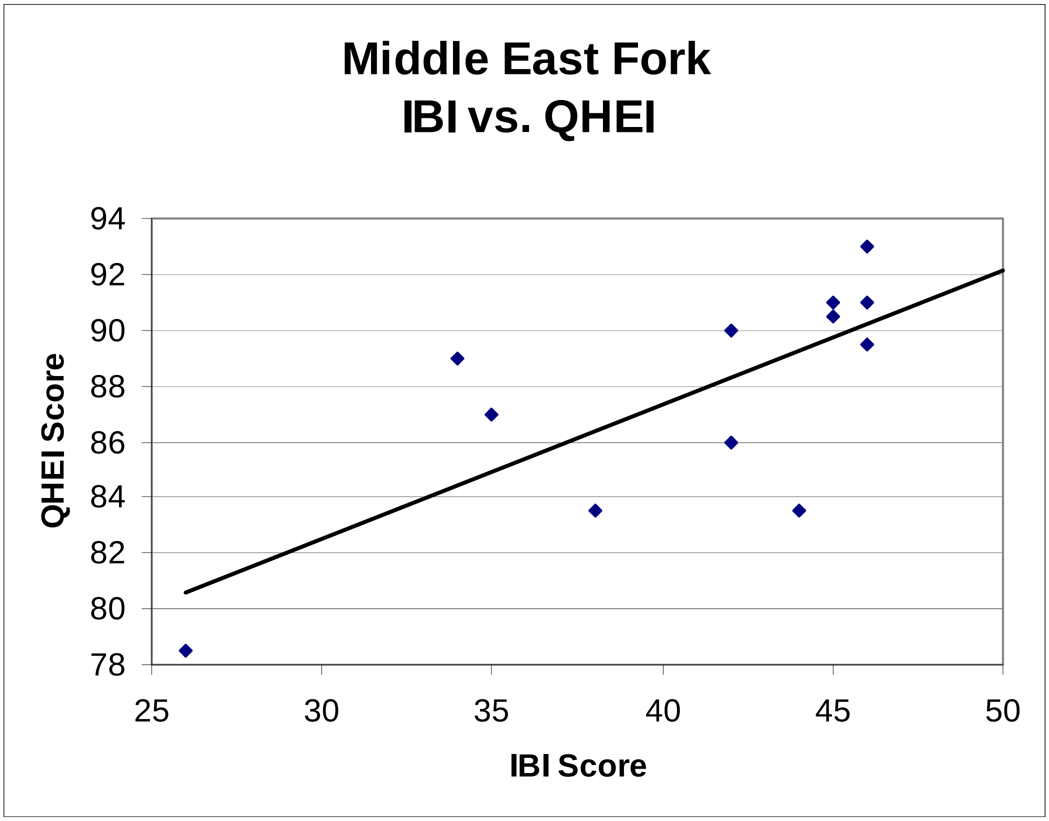


Figure 3-10. IBI vs. QHEI Scores.

Water Chemistry – Ohio EPA Assessment

The results of water chemistry sampled conducted by Ohio EPA are summarized by stream segment in the 2000 *Water Quality Resource Inventory*. Within the Middle East Fork segment, the report references Clermont County data indicating the nutrients, particularly nitrates, were elevated in this segment beginning downstream of the Middle East Fork Waste Water Treatment Plant (WWTP) at RM 12.59, although neither the fish or macroinvertebrate communities reflected an immediate impact. The data also showed spikes of nutrients occurring throughout the segment, with a general increasing trend in phosphorus and nitrate downstream from the Batavia and Middle East Fork WWTPs.

Water Chemistry – Clermont County Assessments

Clermont County collected water chemistry data from various sections of the Middle East Fork sub-watershed from 1996 through 2002. This involved collecting grab samples at these locations periodically over the April-October sampling season in an effort to characterize stream chemistry under a broad range of environmental conditions. Six sites on the mainstem East Fork (RM 9.1, RM 11.3, RM 12.7, RM 13.6, RM 15.6, and RM 20.5 just downstream of the East Fork Lake dam) were sampled. Lucy Run at RM 0.3 was sampled from 1997 through 2002, while Fourmile Run was sampled at RM 0.2 from 1996 through 2000. See Figure 3-11 for sample site locations.

Parameters of interest to the county fall into five general categories: Nutrients, Suspended Solids, Bacteria, Organic Enrichment/Dissolved Oxygen, and Metals.

Nutrients
Ohio EPA has established water quality criteria for some nutrients, while criteria for others have not yet been developed. Criteria have been estab-

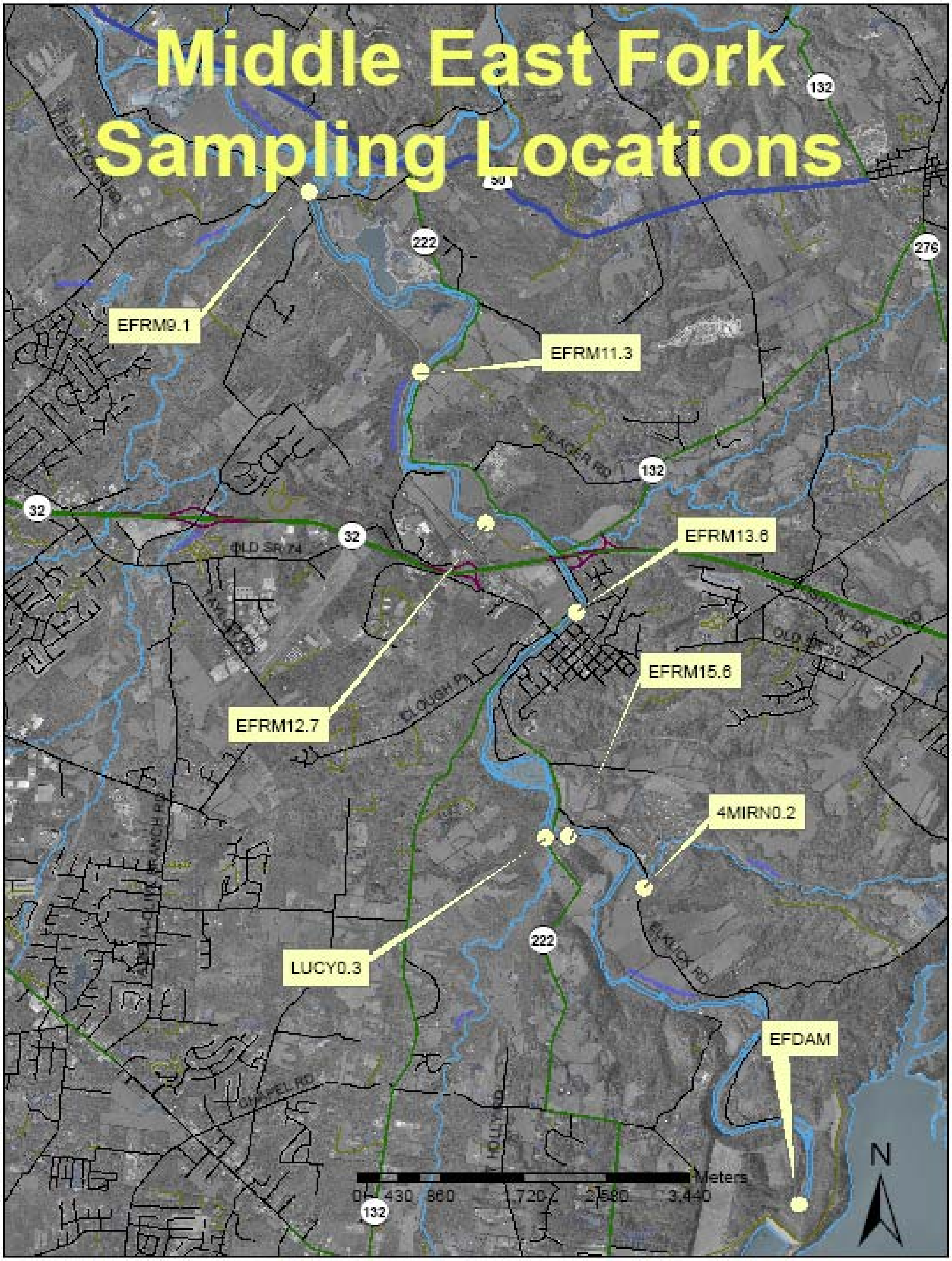


Figure 3-11. Clermont County Ambient Sampling Locations.

Nutrients

The two nutrients of primary interest to water quality managers are nitrogen (N) and phosphorus (P). While these elements are essential nutrients for many aquatic plants, high concentrations can lead to excessive plant growth. This is usually followed by massive die-offs which result in large amounts of detrital matter, the bacterial degradation of which can ultimately deplete the water of its oxygen, leading to anoxic conditions incapable of supporting aquatic life. Nutrients can enter streams from agricultural sources (fertilizer application to row-crops and pasture/feed-lot run-off), from failing or improperly maintained home sewage treatment systems, or from improperly treated sewage from municipal wastewater treatment plants.

Nitrogen exists in several forms in the aquatic environment. These include nitrate, nitrite, ammonia, and organic nitrogen. Organic nitrogen includes such natural materials as proteins and peptides, nucleic acids and urea, and numerous synthetic organic materials. Phosphorus occurs in streams almost solely as phosphates. These are classified as orthophosphates, condensed phosphates, and organically bound phosphates. Orthophosphates are a primary component of many agricultural fertilizers.

In an effort to identify potential sources of nutrient contamination, water quality managers will often sample streams not only for total nitrogen and total phosphorus, but also for the various forms in which these elements exist in the aquatic environment

lished for ammonia based on its toxicity to aquatic life. Ammonia-nitrogen (NH_3-N) has a more toxic form at high pH and a less toxic form at low pH, un-ionized ammonia (NH_3) and ionized ammonia (NH_4^+), respectively. In addition, ammonia toxicity increases as temperature rises. Therefore, criteria values also vary by temperature and pH. For Exceptional Warmwater Habitats, these values range from a high of 13 mg/L in low pH/low temperature conditions to a low of 0.7 mg/L for high temperature/high pH conditions. For Warmwater Habitat, criteria values range from a high of 13.0 mg/L to a low of 1.1 mg/L.

Criteria for nitrites/nitrates and total phosphorus have not been established; however, criteria development for these parameters is in progress. One possible source for numeric nutrient targets is a technical bulletin published by Ohio EPA entitled "Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams (Ohio EPA, 1999). The nutrient criteria proposed in this document for different drainage areas and use designations are listed in Table 3.6. For the mainstem of the East Fork Little Miami River in the Lake Tributaries sub-watershed, the EWH Small River criteria would be applicable, while all of the tributaries in the sub-watershed would be classified as WWH Wadable streams.

Total Kjeldahl Nitrogen (TKN) is a measure of the concentration of organic nitrogen and ammonia in a stream. To date, the Ohio EPA has not established criteria values for TKN. Likewise,

Stream Type	Drainage Area	Proposed NO3-NO2	Proposed TP
EWH Wadable	20 mi^2 < DA < 200 mi^2	0.5 mg/L	0.05 mg/L
EWH Small River	200 mi^2 < DA < 1000 mi^2	1.0 mg/L	0.10 mg/L
WWH Wadable	20 mi^2 < DA < 200 mi^2	1.0 mg/L	0.10 mg/L
WWH Small River	200 mi^2 < DA < 1000 mi^2	1.5 mg/L	0.17 mg/L

Table 3-6. Ohio EPA Suggested Nutrient Criteria (*taken from Association Between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams, Ohio EPA, 1999)***.**

there are currently no criteria values for ortho-phosphates.

Suspended Solids

Suspended solids are defined as that material in a water sample that can be retained by a filter. Waters with high amounts of suspended solids tend to be more turbid and, therefore, aesthetically unsatisfactory for purposes such as bathing. They also tend to be less palatable as a source of drinking water. Currently, the Ohio EPA does not have in-stream criteria values for suspended solids.

Bacteria

Fecal Coliform and *E. coli* provide information regarding the extent to which streams are being contaminated by human or animal waste. They are primarily used to determine if streams are meeting their primary contact recreation use, i.e. are the waters safe for people to use for swimming and other recreational activities. Ohio EPA has established Fecal Coliform criteria for all streams designated for primary contact recreation use, including all those monitored by Clermont County. The current Fecal Coliform criteria are:

- Geometric mean based on not less than five samples in a 30-day period shall not exceed 1000 colony forming units (cfu) per 100 mL.
- Fecal Coliform content shall not exceed 2000 cfu/100 mL in more than 10 percent of the samples collected in a 30-day period.

Ohio EPA has also established *E. coli* criteria for all streams designated for primary contact recreation use. The current *E. coli* criteria are:

- Geometric mean based on not less than five samples in a 30-day period shall not exceed 126 colony forming units (cfu) per 100 mL.
- *E. coli* content shall not exceed 298 cfu/100 mL in more than 10 percent of the samples collected in a 30-day period.

While the data collected by Clermont County cannot be directly compared to the criteria due to the frequency of sampling, the criteria can still be used as a guideline to assess stream conditions.

Organic Enrichment/Dissolved Oxygen

Clermont County determines organic enrichment in its streams by measuring carbonaceous biological oxygen demand ($CBOD_5$). $CBOD_5$ represents a measure of the amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter. This represents the potential of organic contaminants to strip life-supporting oxygen from the stream through these processes. The Ohio EPA currently does not have criteria values for $CBOD_5$. A more direct measure of this type of impact is the determination of actual dissolved oxygen concentrations in the stream. Dissolved oxygen criteria for both EWH and WWH streams have been established by Ohio EPA. Criteria include:

- Minimum in-stream concentration of 4.0 mg/L for WWH streams; 5.0 for EWH streams.
- Minimum 24-hour average concentration of 5.0 mg/L for WWH streams; 6.0 for EWH streams.

Metals

Many metals are toxic to aquatic life, some at relatively low concentrations. Ohio EPA criteria states that concentrations must not exceed 2.5 ug/L for cadmium, 86 ug/L for chromium, 9.3 ug/L for copper, 6.4 ug/L for lead, 470 ug/L for nickel, and 120 ug/L for zinc (assuming a hardness concentration of 100 mg/L).

Results – Ambient Sampling

Ambient sampling results for the six locations on the mainstem of the East Fork Little Miami River are presented in Table 3-7 – Table 3-12, while Tables 3-13 and Table 3-14 present the results of ambient sampling on the two EFLM tributaries (Lucy Run and Fourmile Run).

Nutrients

Annual average ammonia concentrations were below OEPA criteria values for all sites and all years. On the East Fork mainstem, both nitrites/nitrates and total phosphorus concentrations tended to increase in value from upstream to

EFLM RM9.1 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.12	0.10		0.09	0.15	0.15	0.10
Nitrate/Nitrite (mg/L)	1.37	2.07		1.84	1.03	1.30	1.63
Total Kjeldahl Nitrogen (mg/L)	0.97	0.97		1.07	1.09	1.06	1.25
Ortho-phosphorus (dissolved) (mg/L)	0.20	0.23		0.33	0.14	0.12	0.11
Total Phosphorus (mg/L)	0.25	0.34		0.39	0.41	0.18	0.27
Suspended Solids (mg/L)	23.57	18.67		12.69	73.38	27.8	38.84
E. coli. (c.f.u./100 mL)				352.55	276.07	228.42	120.24
Fecal Coliform (c.f.u./100 mL)	85.2	121.49					
CBOD5 (mg/L)	2.01	2.00		2.00	2.46	2.28	2.04
Dissolved Oxygen (mg/L)	9.02	9.06		6.86	7.53	8.17	
Cadmium (ug/L)	0.13						
Chromium (ug/L)	1.07						
Copper (ug/L)	4.83						
Lead (ug/L)	1.49						
Nickel (ug/L)	1.81						
Zinc (ug/L)							

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3-7. East Fork Little Miami River RM 9.1 Ambient Sampling Data.

EFLM RM11.3 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.14	0.11	0.12	0.16	0.11	0.17	0.11
Nitrate/Nitrite (mg/L)	1.44	1.94	1.30	1.97	0.96	1.35	1.69
Total Kjeldahl Nitrogen (mg/L)	0.97	1.00	1.03	1.15	1.04	1.05	0.88
Ortho-phosphorus (dissolved) (mg/L)	0.17	0.21	0.20	0.38	0.15	0.13	0.11
Total Phosphorus (mg/L)	0.23	0.29	0.27	0.48	0.28	0.49	0.18
Suspended Solids (mg/L)	16.91	17.52	27.68	12.29	28.7	17.16	9.52
E. coli. (c.f.u./100 mL)			311.2	211.6	172.6	421.1	224.1
Fecal Coliform (c.f.u./100 mL)	263.98	171.6					
CBOD5 (mg/L)	2.14	2.04	1.82	2.00	2.27	2.28	2.00
Dissolved Oxygen (mg/L)	8.70	8.42	7.88	6.96	8.04	7.89	
Cadmium (ug/L)	0.15						
Chromium (ug/L)	1.44						
Copper (ug/L)	5.99				4.57	6.10	
Lead (ug/L)	2.04				2.00	2.00	
Nickel (ug/L)	2.76						
Zinc (ug/L)					10.30	20.00	

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3-8. East Fork Little Miami River RM 11.3 Ambient Sampling Data.

EFLM RM12.7 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.13	0.10	0.12	0.03	0.10	0.17	0.11
Nitrate/Nitrite (mg/L)	0.80	1.02	0.72	0.25	0.53	0.73	0.69
Total Kjeldahl Nitrogen (mg/L)	0.89	0.88	1.00	0.82	0.99	0.92	0.80
Ortho-phosphorus (dissolved) (mg/L)	0.08	0.06	0.09	0.07	0.08	0.09	0.07
Total Phosphorus (mg/L)	0.17	0.14	0.17	0.11	0.16	0.13	0.18
Suspended Solids (mg/L)	20.29	18.71	26.14	9.91	21.4	13.68	13.38
E. coli. (c.f.u./100 mL)			254.7	105.6	147.19	241.22	419.6
Fecal Coliform (c.f.u./100 mL)	193.24	155.86					
CBOD5 (mg/L)	2.13	2.02	1.82	2.01	2.26	2.23	2.00
Dissolved Oxygen (mg/L)	10.73	8.97	8.27	7.67	7.89	8.16	
Cadmium (ug/L)	0.11						
Chromium (ug/L)	1.44						
Copper (ug/L)	4.05				5.19	14.62	
Lead (ug/L)	1.75				2.00	2.00	
Nickel (ug/L)	2.17						
Zinc (ug/L)					102.00	21.67	

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3-9. East Fork Little Miami River RM 12.7 Ambient Sampling Data.

EFLM RM13.6 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)		0.10	0.12	0.05	0.18	0.23	0.10
Nitrate/Nitrite (mg/L)		1.09	0.68	0.23	0.49	0.76	0.64
Total Kjeldahl Nitrogen (mg/L)		0.93	0.87	0.85	1.02	1.07	0.87
Ortho-phosphorus (dissolved) (mg/		0.04	0.08	0.05	0.07	0.08	0.06
Total Phosphorus (mg/L)		0.12	0.17	0.07	0.19	0.21	0.17
Suspended Solids (mg/L)		17.76	21.43	7.82	32.51	42.73	17.86
E. coli. (c.f.u./100 mL)			183.63	105.48	225.13	419.13	252.82
Fecal Coliform (c.f.u./100 mL)		128.5					
CBOD5 (mg/L)		2.00	1.81	1.47	2.03	2.42	2.00
Dissolved Oxygen (mg/L)		8.23	8.27	7.67	8.53	8.71	
Cadmium (ug/L)							
Chromium (ug/L)							
Copper (ug/L)							
Lead (ug/L)							
Nickel (ug/L)							
Zinc (ug/L)							

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3-10. East Fork Little Miami River RM 13.6 Ambient Sampling Data.

EFLM RM15.6 Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.15	0.10					
Nitrate/Nitrite (mg/L)	0.68	1.16					
Total Kjeldahl Nitrogen (mg/L)	1.01	0.92					
Ortho-phosphorus (dissolved) (mg/L)	0.07	0.04					
Total Phosphorus (mg/L)	0.14	0.12					
Suspended Solids (mg/L)	13.17	16.77					
E. coli. (c.f.u./100 mL)							
Fecal Coliform (c.f.u./100 mL)	65.9	99.18					
CBOD5 (mg/L)	2.01	2.00					
	8.61	10.04					
Cadmium (ug/L)	0.12						
Chromium (ug/L)	0.88						
Copper (ug/L)	7.41						
Lead (ug/L)	1.47						
Nickel (ug/L)	1.97						
Zinc (ug/L)							

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table 3-11. East Fork Little Miami River RM 15.6 Ambient Sampling Data.

EFDAM Ambient Sampling - Annual Average Values (EWH Small River)

PARAMETER	1996	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.23	0.16	0.17	0.09	0.23	0.28	0.29
Nitrate/Nitrite (mg/L)	0.34	1.06	0.63	0.22	0.46	0.59	0.46
Total Kjeldahl Nitrogen (mg/L)	1.01	1.05	1.05	0.93	1.06	1.13	1.25
Ortho-phosphorus (dissolved) (mg/L)	0.06	0.03	0.07	0.03	0.08	0.07	0.08
Total Phosphorus (mg/L)	0.15	0.11	0.17	0.08	0.14	0.14	0.21
Suspended Solids (mg/L)	13.85	10.17	11.88	4.91	6.31	5.63	9.26
E. coli. (c.f.u./100 mL)			22.39	10.99	22.31	7.24	32.22
Fecal Coliform (c.f.u./100 mL)	8.3	13.7					
CBOD5 (mg/L)	2.04	2.05	1.97	2.12	2.28	2.18	2.11
Dissolved Oxygen (mg/L)	9.61	10.22	8.72	7.95	8.76	8.13	
Cadmium (ug/L)							
Chromium (ug/L)	5.74						
Copper (ug/L)	2.70		4.75	2.40			
Lead (ug/L)	0.90		1.85	1.76			
Nickel (ug/L)	4.20						
Zinc (ug/L)			12.24	25.90			

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parameter

Table -12. East Fork Little Miami River @ Harsha Lake Dam Ambient Sampling Data.

Lucy Run, RM 0.3 Ambient Sampling - Annual Average Values (WWH Wadable)

PARAMETER	1997	1998	1999	2000	2001	2002
Ammonia (mg/L)	0.10	0	0.08	0.10	0.10	0.10
Nitrate/Nitrite (mg/L)	0.18	0.24	0.21	0.24	0.41	0.31
Total Kjeldahl Nitrogen (mg/L)	0.67	0.49	0.73	0.46	0.61	0.52
Ortho-phosphorus (dissolved) (mg/L)	0.04	0.04	0.05	0.05	0.06	0.02
Total Phosphorus (mg/L)	0.07	0.09	0.09	0.07	0.16	0.07
Suspended Solids (mg/L)	9.56	17.14	9.57	6.41	49.59	2.51
E. coli. (c.f.u./100 mL)		267.4	135.37	155.54	704.6	282.89
Fecal Coliform (c.f.u./100 mL)	81.42					
CBOD5 (mg/L)	2.08	2.01	1.60	2.00	2.38	2.10
Dissolved Oxygen (mg/L)	7.64	8.35	7.53	8.56	8.74	

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parame

Table 3-13. Lucy Run RM 0.3 Ambient Sampling Data.

Fourmile Run, RM 0.2 Ambient Sampling - Annual Average Values (WWH Wadable)

PARAMETER	1996	1997	1998	1999	2000
Ammonia (mg/L)	0.10	0.11	0.10	0.10	0.10
Nitrate/Nitrite (mg/L)	0.30	0.55	0.35	0.39	0.45
Total Kjeldahl Nitrogen (mg/L)	1.03	0.71	0.58	2.26	0.66
Ortho-phosphorus (dissolved) (mg/L)	0.11	0.04	0.03	0.03	0.05
Total Phosphorus (mg/L)	0.40	0.14	0.08	0.05	0.06
Suspended Solids (mg/L)	131.33	21.62	23.27	2.05	7.9
E. coli. (c.f.u./100 mL)					
Fecal Coliform (c.f.u./100 mL)	122.16	104.76	175.08	119.15	301.38
CBOD5 (mg/L)	1.91	2.02	1.80	1.64	2.26
Dissolved Oxygen (mg/L)	9.23	9.88	8.80	8.72	8.65
Cadmium (ug/L)	0.17				
Chromium (ug/L)	3.71				
Copper (ug/L)	10.13				
Lead (ug/L)	4.60				
Nickel (ug/L)	6.41				
Zinc (ug/L)					

E. coli and Fecal Coliform values are geometric means.
Green = Meets Exisiting or Proposed Criteria for this Parameter
Red = Does Not Meet Existing or Proposed Criteria for this Parameter
Black = No Existing or Proposed Criteria for this Parame

Table 3-14. Fourmile Run RM 0.2 Ambient Sampling Data.

downstream, particularly below the Batavia and Middle East Fork wastewater treatment plants (Figure 3-12 and Figure 3-13). This is consistent with comments made by the Ohio EPA in the 2000 *Ohio Water Resources Inventory* 305(b) report. It should be noted that, even above the WWTPs, average total phosphorus concentrations for almost every year and sampling location were above the proposed criteria value of 0.08 mg/L for a EWH small river. Very few of the annual average concentrations for nitrites/nitrates exceeded the proposed criteria value of 1.0 mg/L above the WWTPs, while a majority of the values below the WWTPs excceded this value. In 1997, all sampling locations had average nitrites/nitrates concentrations above 1.0 mg/L. The reason for these high values is unknown.

The Lucy Run data show very low nutrient concentrations for every year sampled. In Fourmile

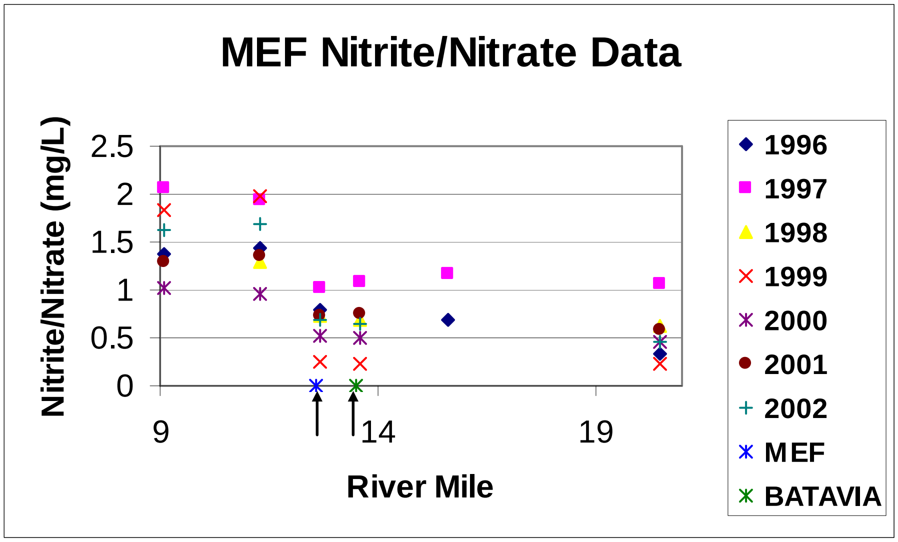


Figure 3-12. Middle East Fork Nitrite/Nitrate Data.

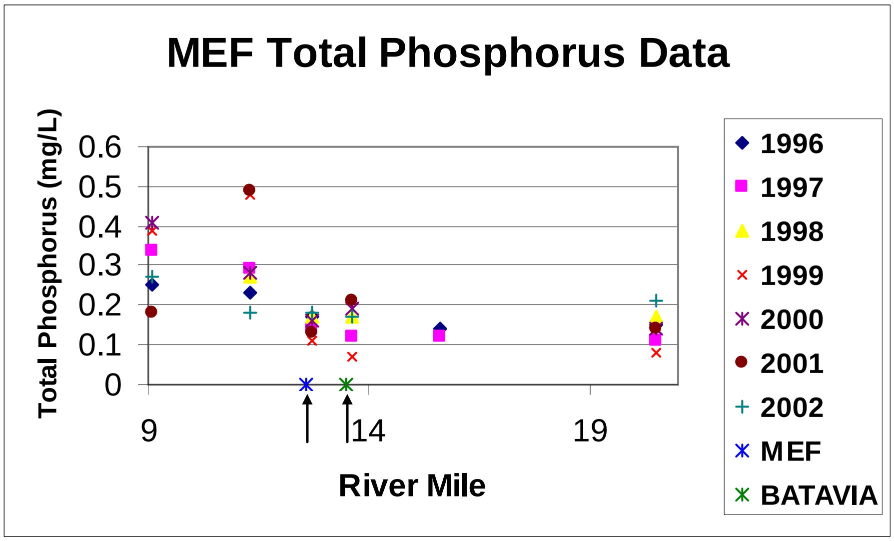


Figure 3-13. Middle East Fork Phosphorous Data.

Run, annual average total phosphorus concentrations exceeded the proposed criteria value of 0.1 mg/L for WWH wadable streams in 1996 and 1997, but fell below this threshold in 1998-2000. Annual average values for nitrites/nitrates in Fourmile Run were below the proposed criteria value for every year sampled.

Suspended Solids

There does not appear to be any spatial or temporal trends in the suspended solids data from the ambient monitoring program. For those years in which a sampling location had an average value slightly higher than the norm, it was usually due to a high value associated with a single sampling event that followed a heavy rainfall. As no existing or proposed criteria values exist for this parameter, it is difficult to interpret the potential impact of these results.

Bacteria

Clermont County analyzed water samples for fecal coliform in 1996 and 1997. Beginning in 1998, the county started analyzing samples for *E. coli*. None of the annual geometric mean values for fecal coliform exceeded the OEPA criteria value of 1000 c.f.u./100 mL. The lowest values for *E. coli* were seen in the sampling location furthest upstream in the subwatershed (RM 20.5 just below the East Fork Lake dam) (Figure 3-14). None of the annual geometric mean values for *E. coli* at this site exceeded the OEPA criteria. In the middle section of the subwatershed (RM 11.3, RM 12.7 and RM 13.6), all but one of the annual geometric mean *E. coli* values exceeded the criteria value. Excessive *E. coli* values were also observed at RM 9.1 in 1999, 2000, and 2001, but dropped below the criteria value in 2002 (Figure 3-14). All of the *E. coli* values for Lucy Run, RM 0.3 exceeded OEPA criteria values, while none of the samples collected in Fourmile Run did so.

The high E. coli counts observed in the middle section of the Middle East Fork subwatershed may be due to insufficient treatment by the Batavia and/or Middle East Fork wastewater treatment plants. More likely they may be due to failing home sewage treatment systems located in the area. The home systems are also a likely source for the contamination observed in Lucy Run.

Organic Enrichment/Dissolved Oxygen

Annual average values for $CBOD_5$ in the ambient water quality monitoring program were very close to the detection limit of 2.0 mg/L for every sampling location and year. Average annual dissolved oxygen levels consistently exceeded OEPA criteria values of 5.0 mg/L for WWH streams and 6.0 mg/L for EWH streams.

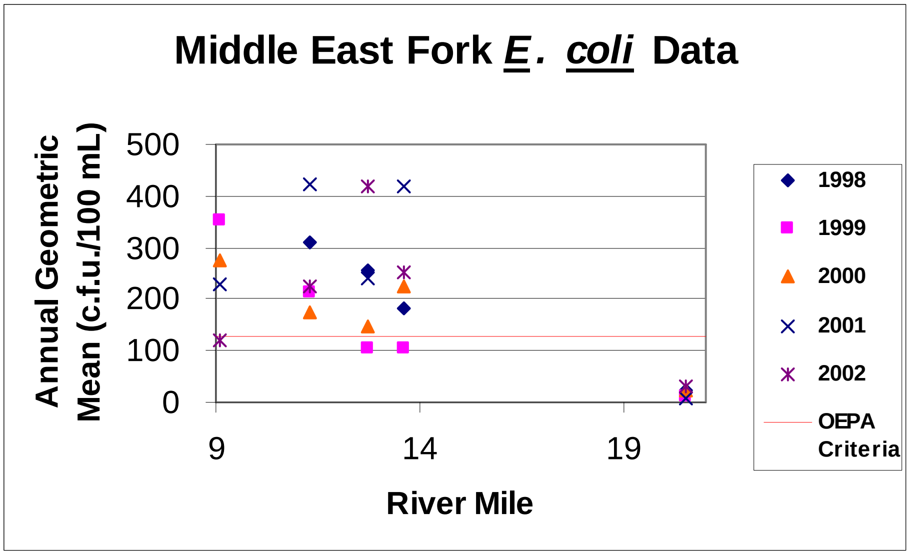


Figure 3-14. Middle East Fork E. coli Data.

Metals

Ambient water samples were analyzed for numerous metals in various years, including six (cadmium, chromium, copper, lead, nickel and zinc) for which the OEPA has criteria values (2.5 ug/L, 86 ug/L, 9.3ug/L, 6.4 ug/L, 470 ug/L and 120 ug/L respectively). Cadmium, chromium, lead, nickel and zinc concentrations in the mainstem East Fork Little Miami River were consistently below EPA critera values for all sites and all years. Of the 91 individual samples collected in the mainstem EFLM during this period, only 12 had copper concentrations over the OEPA instream criteria value of 9.3 mg/L, with a high value of 40.2 ug/L in a sample collected at RM 12.7 on May 8, 2001. None of the sites had annual average metal concentrations greater than the OEPA criteria. While the county has never analyzed samples from Lucy Run for metals contamination, several samples from Fourmile Run, RM 0.2 were analyzed in 1996 for metals. The sample collected on September 16 of that year had a copper concentration of 39.6 ug/L and a lead concentration of 21.6 ug/L. All other metal values for Fourmile Run were below OEPA criteria. Based on an assessment of these data, metals contamination does not appear to be a problem in the Middle East Fork subwatershed.

Middle East Fork Watershed Action Plan

Chapter 4

Community Water Management Goals & Interests

East Fork
WATERSHED COLLABORATIVE

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eastforkwatershed.org

CHAPTER 4: COMMUNITY WATER MANAGEMENT GOALS AND INTERESTS

For any plan to be implemented, the recommendations must be in the interest of the individuals and organizations (including businesses and local governments) that make up the community.

This chapter summarizes the water management interests, issues and concerns that were identified by a broad group of stakeholders who live and work in the Middle East Fork watershed. In response to those interests, a series of water management goals were developed, and a broad suite of strategies were identified to achieve those water management goals. The strategies introduced in this chapter also serve as the basis for the recommended actions to achieve water quality goals outlined in Chapter 5 - Watershed Recommendations. This chapter begins with a description of the process used to identify water management interests, issues and concerns, and then to develop the goals and strategies to address those areas of need.

Middle East Fork Stakeholder Involvement Process

The process for identifying community water management goals and interests for the Lower East Fork and Lake Tributaries Watershed Action Plans was incorporated into the Middle East Fork sub-watershed planning process. Due to the geography of the Middle East Fork planning region many of the stakeholders located in the Middle East Fork were also represented in the Lower East Fork and Lake Tributaries planning process. Therefore, the East Fork Watershed Collaborative decided to review the issues, interests, and water management goals identified during those planning processes and assess their applicability toward the Middle East Fork. This was the first step in the Middle East Fork planning process, the process was followed by several steps:

Invitation to Participate in the Planning Process

The watershed coordinator made every effort to meet with each county board of commissioners, township board and village council to describe the watershed planning effort and to invite their participation in the planning process. We requested representation from each board. We also extended the same invitation to county agencies (SWCDs, county engineers, health districts, planning departments,...), businesses, developers, interest groups (Farm Bureau, Buckeye United Fly Fishers, etc.), and individual landowners in the watershed (see page 4-2 for complete invitation list).

Issue Identification

On November 8, 2006 the Collaborative held one Middle East Fork planning meeting at the Clermont County Engineers Conference Room. Three major tasks were accomplished by participants at the meeting: (1) stakeholders were given a summary of the watershed inventory, (2) an exhaustive list of water management interests, issues and concerns was generated, and (3) the issues were organized into groupings of related issues and strategies were developed for addressing the issues. The 15 community members who participated represented county, township, and village governments, as well as other diverse interests (the attendance list is included in Table 4.1).

It is important to note that many of the issues identified during this process were similar to those identified during the Lower East Fork and Lake Tributaries planning meetings. The Lower East Fork and Lake Tributaries Watershed Action Plans can be viewed and downloaded at clermontswcd.org and www.oeq.net.

Middle East Fork Issue Framing Meeting Stakeholder Invitation List
11/8/06 at 5:00-6:15 pm Clermont County Engineers Conference Room

Hugh Trimble, Ohio EPA-DSW
Jeff Thomas, ODNR-DSWC
Eric Partee, Executive Director, Little Miami Inc.
Robert Proud, Clermont County Commissioner
Mary Walker, Clermont County Commissioner
Scott Crosswell, Clermont County Commissioner
Dave Spinney, Clermont County Administrator
Ray Sebastian, Clermont County Building Department
Scott Lahrmer, Assistant Clermont County Administrator
Rex Parsons, Batavia Township Administrator
Robert Stewart, Village of Batavia Administrator
Chris Dauner, Regional Park Manager, East Fork and Stonelick State Parks
Dennis TenWolde, Executive Director, Watershed Coordinator, LMRP
Paul Braasch, Director Adams-Clermont Solid Waste District and Clermont Office of Environmental Quality
John McMannus, Clermont County Stormwater Department
Dennis McMullen, Project Manager, Clermont Office of Environmental Quality
Mark Day, Asst. Director of Utilities, Clermont Co. Water and Sewer District
Thomas Yeager, Director of Utilities, Clermont Co. Water and Sewer District
William Gollnitz, Clermont Co. Water and Sewer District
Dave Zagurny, US Army Corps of Engineers – Harsha Lake
Red Barn Flea & Antique Market Representative
Hal Shevers, Clermont County Sporty's Airport
Jim Sauls, Sauls Construction
Stephanie Hines, OSU Extension – Clermont County
Michael Kavanaugh, Local Landowner and Resource Economist
Robert Wildey, Clermont Co. General Health District
Jim Wilson, Clermont SWCD Board Member, Wilson Brothers Realty
Angelo Santoro, Santoro Engineering
Andrew Kuchta, Clermont Co. Office of Economic Development
Chris Clingman, Clermont Co. Park District
Paul Berringer, District Supervisor, Clermont SWCD
Jason Brown, East Fork Watershed Coordinator
Michelle Gardner, Batavia Village Council
Kathleen B. Leone, Batavia Village Council
Kathy Turner, Batavia Village Council
Ray Seibert, Batavia Village Council
Robert Handra, Batavia Village Council
Mayor John Thebout, Batavia Village Council
Tim Hershner, Clermont Co. Planning Coordinator
Lyle Bloom, Clermont Co. Sanitary Engineer
Melvin Kipp, Kipp's Gravel
Ron Singleton, Singleton Homes
Amie Imbus, President, Clermont Co. Home Builders Association
Michelle Fleck, Clermont Co. Home Builders Association
Pat Manger, Clermont Co. Engineers Office
Michele Girard, Village of Amelia
Andrew Parker, Village of Amelia
Pamela Troxell, Village of Amelia
Eric Kelso, Village of Amelia
Robert D. Tasch, Village of Amelia
Michael Scharf, Village of Amelia
Mark Menz, Village of Amelia
Kerry Schulze, Village of Amelia
Trustee Deborah Hall Clepper, Batavia Township
Trustee Archie Wilson, Batavia Township
Trustee Lee Cornett, Batavia Township
Jennifer Haley, Fiscal Officer, Batavia Township
Angel Burton, Clerk, Batavia Village Council
Andy Dickerson, Little Miami Inc.
Greg Smith, Sportsman Club
John Kennard, BUFF
Scott Runck, Batavia Village Council

Strategy Development and Prioritization

During the Middle East Fork planning meeting each participant was given a Watershed Action Form (Figure 4-1) developed by the watershed coordinator. Each participant used the form to list; (1) impairments or threats to water quality, (2) source of impairment or threat, (3) recommended actions, and (4) rank priority of impairment or threat. Time was allotted during the meeting for participants to fill out the forms, followed by a period for discussion. Upon completion of this process each form was carefully reviewed by the watershed coordinator and applied toward the recommended actions set forth in Chapter 5. The priority rankings given to each impairment or threat was carefully weighed from each form and represented in Chapter 5.

The factors that went into their priority determination included: 1) the importance of the action for achieving the stated goal; 2) the return on investment (i.e., are we accomplishing a lot with the resources used); 3) the "doability" (person or entity available and willing to take leadership, funding or personnel available to accomplish the task, community and/or political support {or opposition}, etc.); and 4) opportunistic within a strategic approach based on water quality goals and cost effectiveness.

The Issues

Table 4-2 summarizes the water management interests, issues and concerns identified during the November 8, 2006 Middle East Fork planning meeting. These issues were consistent with issues identified during the Lower East Fork and Lake

Name	Organization
Paul Berringer	Clermont Soil and Water Conservation District
Paul Braasch	Adams-Clermont Solid Waste District and Clermont Office of Environmental Quality
Jason Brown	East Fork Watershed Coordinator
Chris Clingman	Clermont County Park District
William Gollintz	Clermont County Water and Sewer District
Stephanie Hines	Clermont County OSU-Extension Office
Dennis McMullen	Clermont Office of Environmental Quality
Ray Sebastian	Clermont County Planning Department
David Spinney	Clermont County, County Administrator
Robert Stewart	Village of Batavia, Village Administrator
Dennis TenWolde	Little Miami River Partnership (LMRP)
Hugh Trimble	Ohio EPA-Division of Surface Water
Robert Wildey	Clermont County Health District
Jim Wilson	Local Landowner, Real Estate Agent, and Clermont Soil and Water Conservation District Board Member
David Zagurny	USACE-Harsha Lake Park Manager

Table 4-1. Middle East Fork Planning Meeting Participants

Middle East Fork Watershed Action Plan
Watershed Impairments, Threats, and
Recommended Actions
Name of person filling out form: ________________

Impairment or Threat to Water Quality	Source of Impairment or Threat	Recommended Action(s)	Priority*
Habitat Alteration	Land use change; land development/suburbanization	Qualitative Habitat Assessments (QHEI's); riparian setbacks; conservation development practices; education/awareness; riparian and floodplain protection; stream restoration	
Siltation	Land development; stormwater runoff; bank erosion		
Pathogens (e.g., E.coli, fecal coliform, giardia)	Failing Household Sewage Treatment Systems (HSTS); non-point urban runoff (i.e., impervious surface runoff, stormwater, sanitary sewer overflow); animal waste		
High Nutrients (i.e., phosphorous, nitrogen)	Non-point urban runoff (i.e., impervious surface runoff, stormwater, sanitary sewer overflow); failing HSTS; non-irrigated crop production		
Flow Alteration	Regulated/modified flow development; channelization		
Organic Enrichment/DO	Failing HSTS's; sanitary sewer overflows		

* Rank Priority 1-5 (1 high and 5 low)

Figure 4-1. Watershed Issue and Action Form

East Fork Watershed Collaborative

The East Fork Watershed Collaborative was created with two primary goals in mind. The goal to help maintain the water quality in the East Fork Little Miami River watershed is captured in our mission statement, "to protect and enhance the chemical, physical and biological integrity within the East Fork Little Miami River and its tributaries." But the Collaborative also supports the community in achieving their broader water management goals.

The following were identified by East Fork Watershed Collaborative partners as the primary roles and responsibilities of the Collaborative:

- Serves as a forum to discuss water resource management across jurisdictional boundaries
- Develops watershed plans
- Monitors water quality
- Implements community water quality improvement projects
- Identifies and secures funding for water quality projects
- Educates those who live, work and recreate in the East Fork watershed

For more information about the collaborative see Chapter 1 (p. 3) and Appendix A.

Tributaries planning meetings. Two critical issues distinctive to the Middle East Fork subwatershed are; (1) Batavia lowhead dam and (2) USACE controlled flows from Harsha Dam. These issues are discussed in further detail in Chapter 2; Watershed Inventory.

Recommended Actions

Meeting participants provided several recommended actions concerning the identified issues provided in Table 4-2. These recommended actions were incorporated into the problem statements and action statements provided in Chapter 5; Watershed Recommendations. Table 4-3 summarizes the recommended actions outlined by the Middle East Fork planning meeting participants. It should be noted that a draft of Chapter 5; Watershed Recommendations was sent out to several stakeholders who attended the November meeting for review.

Implementation

Stakeholder involvement is an ongoing process. The Watershed Action Plan is considered a living document and modifications to the existing plan shall reflect the changing conditions with the Middle East Fork communities. Thus, continued participation from key stakeholders will be critical as implementation occurs.

Once the Middle East Fork plan is endorsed, we will meet with key stakeholders to create a two year work plan to implement projects based on the listed criteria. A work plan will accomplish three things: (1) Create a list of implementation projects ranked in order of feasibility; (2) Develop a timeframe for implementation; (3) Establish stakeholder working groups for specific implementation projects. The stakeholder working groups will have a minimum of three working group meetings at the beginning, middle and end of each year during the two year work period. Additional communication will be facilitated through ad hoc meetings and quarterly email updates. At the end of the two year implementation phase, all stakeholders will meet again to assess progress within the watershed.

Monitoring & Assessment	Education
Better studies to identify specific problems More stream/water quality data Put data to use	Raise awareness about watersheds K-12 educational programming Adult education Stormwater education
Protection of Habitat and Natural System Services Stream corridor protection Natural channel migration Streambank erosion Channelization Habitat degradation	**Miscellaneous/Other** Unauthorized dump sites Batavia Lowhead Dam Spills & accidents Pay for services provided Financing projects USACE Controlled flows from Harsha Dam Recreation Stream temperature Livestock (horses) Salt entering streams from roadways Runoff from Golf Courses
Land Use Land use planning and zoning Open space preservation Population growth and cost of services	
Stormwater/Runoff Non-point source pollution Urban runoff Runoff from development	
Wastewater/Sewers/Septics Raw sewage in stream Failing Household Sewage Treatment Systems (HSTS) Grant money available for repair of failing HSTS's Control bacteria Changing EPA requirements No additional requirements without funding to meet requirements Wastewater treatment plants/sludge applications	
Water Quality (General) Water quality – agricultural or urban Meet Ohio EPA standards Increase number of streams attaining all uses Don't create new problems Be responsible for our actions and interactions	

Table 4-2. Watershed Management Interests, Issues and Concerns Identified by Middle East Fork Stakeholders.

Recommended Actions

- Determine Baseline Water Quality of All Streams
- Improve Water Quality to Meet Use Attainment in All Streams
- Develop Complete and Accurate Land Use Inventory
- Riparian and Floodplain Protection through Fee-Simple Purchase and Conservation Easements
- Encourage Open Space and "Green Space" (i.e., pervious surfaces)
- Improve Stormwater Runoff Quality
- Reduce Flood Peaks and Flood Damage
- Reduce Solid Waste in Streams
- Promote and Implement Best Management Practices (BMPs)
- Evaluate Effectiveness of Current Best Management Practices (BMPs)
- Increase Number of Farms Using Nutrient Management Plans
- Increase Number of Farms Using Conservation Plans
- Maintain Properly Functioning Household Sewage Treatment Systems
- Minimize Water Quality Impairments from Wastewater Treatment, Hauling, and Sludge Management
- Conduct Physical/Morphological Assessment of All Streams
- Conduct Habitat Assessments using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA
- Organize, Manage and Communicate Data Efficiently and Professionally
- Establish and Follow Data Quality Protocols
- Evaluate Effectiveness of Practices
- Raise Awareness about Water Quality and Watershed Management
- Work with USACE Concerning Regulated Flow Coming Out of Harsha Lake
- Monitor Water Quality at Harsha Lake Out-Take
- Investigate Cost-benefit Analysis Concerning the Removal of the Batavia Lowhead Dam
- Implement Riparian Setbacks and Conservation Development Practices
- Perform Livestock Inventory
- Homeowner Education Concerning HSTS Function, Drainage, Riparian/Floodplain Protection, and Lawn Fertilizer Application
- Improve Stormwater Regulations
- Expand Centralized Sewers and HSTS Monitoring
- Improve Enforcement of Construction Site Erosion/Sediment Regulations and Stormwater Controls

Table 4-3. Recommended Actions Identified for the Middle East Fork Subwatershed.

Community Survey

The people-side of watershed protection is indeed the most important factor in ensuring the long-term health of our water resources. The Middle East Fork Watershed Action Plan was written to establish a process for water resource protection, and also to provide a strategy for fostering environmental stewardship within the Middle East Fork communities. As the Collaborative moves forward with implementation, community outreach will continue to be an integral part in achieving the desired goals for the watershed. The milestones by which the Collaborative measures success will not only include physical and biological improvements to the river and streams, but will also include the positive changes in attitudes and behaviors of the people living in the East Fork. By working with local partners to garner public support, the Collaborative will also work to effect change on the policy-side of watershed protection, which will also be an important measure of success.

The Collaborative will develop a "Watershed Awareness Survey," to measure social outcomes of watershed initiatives. The survey will be constructed to measure individual awareness, interest and willingness to participate in watershed protection. It can be utilized as a pre– and post– measure to determine the effectiveness of outreach efforts. The findings from these surveys will hopefully lend insight into how and where the Collaborative should focus its efforts, and also provide a list of willing landowners/citizens, who may be included in future initiatives.

Middle East Fork Watershed Action Plan

<u>Chapter 5</u>

Watershed Management Recommendations

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Owensville, OH 45160
eastforkwatershed.org

CHAPTER 5: WATERSHED MANAGEMENT RECOMMENDATIONS

The previous chapters provided the context within which watershed management activities take place, described potential point and non-point sources of pollution (Chapter 2), provided a detailed summary of existing water quality conditions (Chapter 3), and summarized the goals and interests of Middle East Fork watershed stakeholders (Chapter 4). This chapter integrates the information from the earlier chapters and presents a set of recommendations designed to help Middle East Fork streams meet their use attainment. The chapter also includes other recommendations designed to achieve a broader set of water management goals.

Management strategies for the Middle East Fork watershed were developed through a number of stakeholder meetings. Those strategies and the process by which they were developed are summarized in Chapter 4, and further detailed in Appendix A. Within this chapter, the strategies are applied to a given stream segment or subwatershed based on the primary causes or sources of impairment. Where sources of impairment have not been identified, or for those streams for which no water quality data exist, additional monitoring and assessment activities are recommended.

Table 5-1 summarizes the Ohio EPA identified causes and sources of stream impairment in the Middle East Fork watershed by stream segment. Probable sources are listed for each cause of impairment. For example, high in-stream nutrient concentrations and siltation are listed as causes of impairment and probable sources included flow alteration and agricultural and urban runoff.

In addition to Ohio EPA's assessment, the East Fork Watershed Collaborative completed a watershed management study (2007) to determine the primary causes for non-attainment of water quality in the East Fork. The findings showed the biological health of impaired streams was more dependent on habitat factors than reducing pollutant loadings. Also, the flashiness of streams (or frequency/rapidity of short term changes in streamflow) was strongly correlated with the health of fish communities; therefore, controlling stormwater runoff was ranked as a high priority.

Based on these data and information, problem statements and recommended implementation strategies for the Middle East Fork, both the mainstem and tributaries (Figure 5-1), are included in the following pages. Each problem statement provides a summary of use attainment status, and a description of the causes and sources of non-attainment estimated from Ohio EPA biological data and field observations. Estimated pollutant loadings from the different sources are also included.[1] For those stream segments where causes or sources of impairment were listed as unknown, the loading estimates were calculated using available information (i.e., land use, number households septic systems, and livestock numbers). Estimated load reductions are given as percentages and are based on Ohio EPA target values for allowable loads. Allowable loads are based on the LSPC modeled flows and the applicable water quality targets. Target values of 0.08 and 0.10 mg/L for total phosphorous (TP) [varies based on drainage area], 1.0 mg/L for nitrate, and 25 mg/L for total suspended solids (TSS) were used for determining allowable loads. Those values are based on Ohio EPA guidance.

Following each problem statement is a list of goals for addressing the sources of impairment, and a list of recommended management strategies and projects designed to maintain full support of the stream's designated uses. Each task includes potential costs and sources of funding, a time

1. The loadings were estimated using the Loading Simulation Program in C++(LSPC) (see box on following page). These modeling estimates were provided by Tetra Tech, a consultant working with the Collaborative to develop Total maximum Daily Loads (TMDLs) for the East Fork Little Miami River basin. The development of TMDLs will result in more accurate estimates of pollutant loads throughout the watershed.

frame for implementation, and measurable performance goals.

As shown in the following tables, some of the management strategies are relatively inexpensive and easier to accomplish, while others are more expensive and complex. The Collaborative and its partners will continue to search for potential funding sources for these projects, and investigate alternative management strategies if funds are not available.

Updates to this action plan will be made as new funding sources and management strategies are identified.

Target Area	Causes of Impairment	Sources of Impairment
East Fork Little Miami River (East Fork Lake to Stonelick Creek)	flow alteration, high nutrients	regulated/modified flow-development; municipal point sources; non-point source urban runoff (i.e., impervious surface runoff, stormwater); non-irrigated crop production
Lucy Run	habitat alterations, high nutrients, pathogens	channelization-development; non-point source urban runoff (i.e., impervious surface runoff, stormwater, sewer overflow)
Fourmile Run	siltation, habitat alterations	Land development/ suburbanization; channelization-development
Backbone Creek	Not assessed	Not assessed

Table 5-1. Target Area Summary for the Middle East Fork Watershed.
[Source: Ohio Water Resource Inventory. Ohio EPA, 2000]

Load Estimation - The LSPC Model

LSPC is the Loading Simulation Program in C++, a watershed modeling system that includes streamlined Hydrologic Simulation Program Fortran (HSPF) algorithms for simulating hydrology, sediment, and general water quality on land as well as a simplified stream transport models. LSPC has been widely used for assisting with TMDL calculation and source allocations. LSPC was designed to handle very large-scale watershed modeling applications. The model has been successfully used to model watershed systems composed of over 1,000 subwatersheds.

Reference: http://www.epa.gov/athens/wwqtsc/index.html

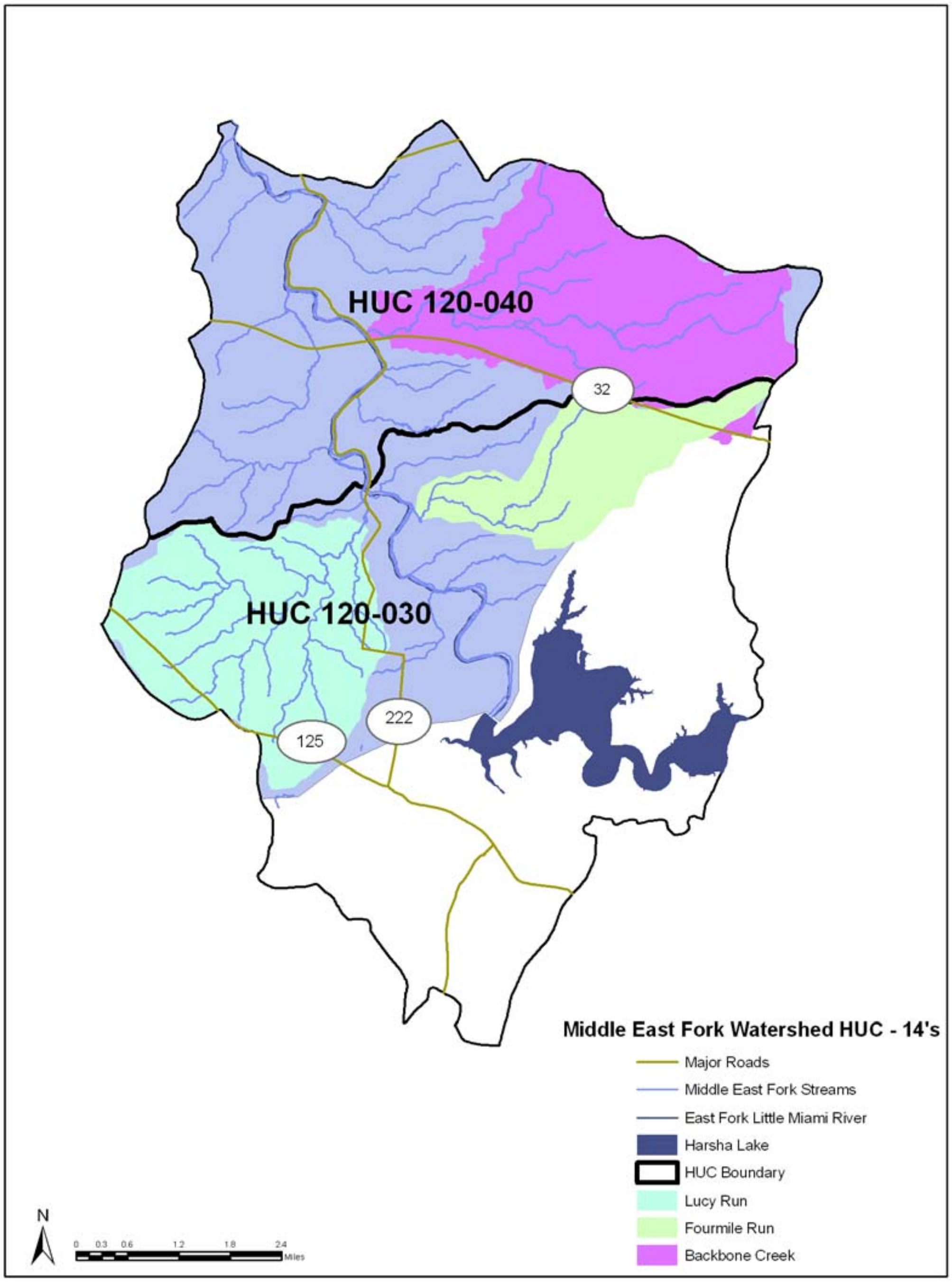

Figure 5-1. 14-digit Hydrologic Unit Codes (HUC-14s) of the Middle East Fork.

[Note: HUC-14s, or 14-digit Hydrologic Unit Codes, are a set of numerical identifiers used by government agencies to communicate about individual streams and watersheds. HUC 120-030 was split at Harsha dam, the remaining portion of this HUC (above Harsha Dam) is included in the Lake Tributaries subwatershed planning area (see Ch.1, p.1, Fig 1-1).]

Middle East Fork Watershed
Subwatershed Planning Unit Drainage Area: 37.8 mi^2
Use Designation: EWH

Background

The Middle East Fork subwatershed planning unit covers 37.8 mi^2 in Clermont County. Ohio EPA's assessment of specific stream segments in the Middle East Fork watershed can be found in the agency's 2000 *Ohio Water Resources Inventory* 305(b) report. Based on these data, approximately 21% (2.5 river miles) of the East Fork Little Miami River (EFLMR) was found to be in "Full, But Threatened" attainment of the river's use designation (Exceptional Warm Water Habitat—EWH), 40% (4.7 river miles) was listed in "Partial" attainment, while the remaining 38% (4.5 river miles) was listed in "Non" attainment.

Of the tributary stream segments monitored by Ohio EPA in 1998, none are fully supporting their aquatic life designated use (Warm Water Habitat-WWH), while 11% (1 mile) was rated "Full, but Threatened". Another 11% of the streams (1 mile) were in "Partial" support, 19% (1.7 miles) were in "Non" attainment, while 58 percent (5.05 miles) were not assessed. It should be noted that the Middle East Fork watershed begins at the outfall of Harsha Lake. The beginning flow of the East Fork mainstem in this subwatershed is regulated by the US Army Corps of Engineers at Harsha Dam.

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that causes of water quality impairment within the Middle East Fork watershed include high nutrient levels, pathogens, siltation, flow alteration and habitat alteration. Land development, suburbanization, stormwater runoff, bank erosion, failing household sewage treatment systems (HSTS), and other non-point urban runoff were noted as sources of impairment to the Middle East Fork. Many miles of stream have not been assessed in the Middle East Fork . Extending water quality assessment into these non-assessed areas of the watershed is a top priority.

Because of the effect of Harsha Lake (i.e., settling and algal uptake) it is difficult to model total loadings that enter the Middle East Fork watershed. A lake model will need to be performed in order to truly capture existing loads and to determine allowable loadings into the Middle East Fork from Harsha Lake. In the absence of lake model calculations, a LSPC model was calculated for the Middle East Fork in order to gain a general understanding of what loadings may be affecting the Middle East Fork, based on water quality data and land use.

According to LSPC estimates the total nitrogen and phosphorus loads for the Middle East Fork watershed are estimated to be 378 and 95 tons per year, respectively. Based on existing and allowable load results from modeled streams in the Middle East Fork watershed it is estimated that a 50% reduction in nitrogen and phosphorous is needed to meet Ohio EPA recommended loads.

The LSPC model predicts that the total sediment load for the Middle East Fork watershed is 5,500 tons per year. The primary sources of sediment are bank erosion and non-point urban runoff. Based on estimated loadings results from the LSPC model no reductions are needed in Total Suspended Solids (TSS). According to model results, the Middle East Fork is meeting Ohio EPA recommended loadings for TSS. This is likely due to the presence of Harsha Lake which acts as a sediment sink. Despite the modeling results, siltation is known to be an issue in many of the tributary systems.

Problem Statement

Elevated nutrient levels, pathogens, siltation, flow alteration and habitat alteration are impairing over 75% of the East Fork Little Miami River and 90% of the assessed tributary systems; over half of all the tributary systems in this sub-watershed have yet to be assessed. Land development, suburbanization, storm water runoff, bank erosion, failing HSTS's, and other non-point urban runoff are the sources of impairment.

Goal

The goal for the Middle East Fork sub-watershed is to reach full attainment of the aquatic life use designation for the EFLMR mainstem and tributary systems by reducing the impacts of nutrients, pathogens, siltation, flow alteration and habitat alteration.

Objectives

Monitoring and Assessment

1. Determine the use attainment status of all non-assessed streams in the MEF
2. Determine habitat quality of the MEF mainstem and tributaries
3. Complete a morphological and stream stability assessment for the mainstem and tributaries
4. Identify and map priority target areas in the MEF
5. Inventory and evaluate Best Management Practices in the MEF
6. Organize, manage and communicate data efficiently and professionally
7. Establish and follow data quality protocols

Manage Water Quality and Water Quantity

1. Reduce loadings of nutrients, pathogens and sediments from point and nonpoint sources
2. Restore natural flow regime to the river where feasible
3. Restore or maintain natural character of the landscape
4. Raise public awareness and foster watershed stewardship

The table that follows presents a set of general recommendations for managing water quality and water quantity throughout the entire Middle East Fork watershed. This extensive set of strategies and recommendations developed through the stakeholder process provides evidence of the complex nature of watershed management, and of the cumulative impact of varying human activities.

2. Unless otherwise noted, all assessments referenced in this chapter were conducted by Ohio EPA scientists.

MONITORING AND ASSESSMENT				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORM-ANCE INDICA-TORS**
Determine use attainment status of all non-assessed streams in the MEF	Conduct Aquatic Life Use assessment of listed streams using OEPA protocols and Level 3 certified data collectors	OEPA staff, Clermont SWCD, Clermont OEQ, partners; Seek funding	2010-2015	Use attainment status determined and reported in technical support document
Determine and monitor habitat quality of MEF mainstem and tributaries	Conduct Qualitative Habitat Evaluation Index (QHEI) assessments of each stream	OEPA staff, or qualified data collector using existing resources	2010-2015	QHEIs completed; reports included in technical support document
Complete a morphological and stream stability assessment for the mainstem and tributaries	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator, with qualified evaluator/ consultant; Ohio EPA 319, WRRSP, or other similar grant	2010-2012	Physical and morphological assessment completed and reported in technical support document
Identify and map priority target areas	Use remote sensing, aerial imagery and field measurements to identify changes in land use, floodplain, in-stream/corridor impairments; Identify potential point and non-point pollution sources	Watershed coordinator, Clermont County staff, OSU Extension, other local partners; FEMA or USACE grant for major streams, other similar grants;	2010-2013	Map of priority target areas
	Create GIS layer of failing or improper HSTS's, and other illicit discharges	Watershed Coordinator, Clermont Health Dept., local partners; existing resources	2010	Identify and correct failing or improper HSTS's, and other illicit discharges

MONITORING AND ASSESSMENT				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORMANCE INDICATORS**
Identify and map priority target areas (continued)	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, environmental group etc…); seek grants/funding	2010-2015	Establish effective citizen monitoring program in East Fork
	Establish 1-2 monitoring stations in Middle East Fork to collect water quality, flow, and rainfall data at the confluence of major tributaries; Measure water quality using OEPA's primary recreational contact criteria	Watershed Coordinator, Clermont OEQ & Storm Water, Clermont SWCD, volunteer monitors; Seek grants to fund monitoring stations and data analyses	2010-2015	Monitoring stations, flow analyses for all tributaries, recreational use status determination
Inventory and evaluate Best Management Practices in the MEF	Inventory practices in use in Middle East Fork	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, NRCS, FSA and partners	2009-2012	Completed inventory of BMPs in Middle East Fork
	Conduct windshield survey during storm events Conduct end-of-field or end of pipe water quality sampling Create and distributed BMP effectiveness survey to land owners Conduct literature/ research review BMP effectiveness	Watershed Coordinator, volunteer monitors, interns and partners; Existing resources or seek grants/ funding	2009-2012	BMP effectiveness database

MONITORING AND ASSESSMENT (continued)				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORMANCE INDICATORS**
Organize, manage and communicate data efficiently and professionally	Form permanent subcommittee of the East Fork Watershed Collaborative to monitor and assess watershed management Develop clear monitoring and assessment goals for the watershed	Watershed Coordinator, partners; Existing resources or watershed grants	2010	EFLMR M&A Team established Goals developed and documented
	Create data clearinghouse for storing/analyzing data; Develop good supporting data (land use, livestock, BMPs, septic systems) Geolocate all data (make GPS, digital cameras available to volunteer monitors)	Watershed Coordinator, M&A Team, volunteers, Clermont SWCD, Clermont OEQ & Storm Water, partners; Existing resources and seek grants	2010-2015	Updated/accurate data and maps; user-friendly water quality database
	Create watershed reports and make available to interested parties Develop recommendations based on data analyses for watershed management	EFLMR M&A Team	Ongoing	Catalog of water quality reports available for technical and lay audiences; Recommendations for future implementation
Establish and follow data quality protocols	Implement standard data checks/audits via unbiased sources to validate data and findings	EFLMR M&A Team	Ongoing	Complete data audit plan for M&A Team

MANAGE WATER QUALITY AND QUANTITY				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORMANCE INDICATORS**
Reduce loadings of nutrients, pathogens and sediments from nonpoint and point sources	Maintain or enhance riparian corridors and stream buffers	Landowners with assistance from watershed coordinator and all partners; NRCS programs, land trusts, Clean Ohio Funds, WRRSP, other similar grants	Ongoing	Miles/percentages and widths of riparian corridors protected within watershed Pollutant load reductions
	Improve soil quality and infiltration through agriculture BMPs (No-till farming, cover crops, etc..) Increase number of farms using nutrient management and conservation plans	Landowners with assistance from watershed coordinators and all partners, education and promotion; NRCS and FSA programs; agricultural consultants seek grants	Ongoing	Contact list of landowners implementing BMP practices Number of acres under management plans
	Manage urban/suburban stormwater runoff by implementing green infrastructure (porous pavement, bioretention, etc…) Promote balanced growth, land use planning	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, volunteers; Clermont SWCD Rain Garden Program, Phase II program, seek grants/local funding	2010-2018	Impervious surfaces <10% in watershed, improved water quality, # of urban/suburban BMPs implemented Low Impact Development workshop and list of participating developers/planners LID demonstration project
	Repair or replace failing HSTS's Develop an effective homeowner education program	Homeowners, Clermont County Health District, Watershed Coordinator, partners; Existing resources, seek low-interest/cost-share funds, similar grants	2010-2018	Repair/replace 20% failing septic systems Educational materials for homeowners, developers, realtors
	Reduce solid waste in streams by enforcing litter/dumping laws	Local police, ODNR, citizen watchdogs; Existing resources	Ongoing	Miles of "Clean" streams

MANAGE WATER QUALITY AND QUANTITY (continued)				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORMANCE INDICATORS**
Reduce loadings of nutrients, pathogens and sediments from nonpoint and point sources (continued)	Minimize water quality impairments from Batavia and Clermont County STPs with effective technologies and monitoring Effective regulation, registration and testing of septic haulers; proper application or disposal of septage	OEPA, local elected officials, Clermont County, Clermont Health District, partners; Low interest loans, cost-share for WWTP upgrades	Ongoing	No NPDES violations No reports of illicit discharges or improper handling of septic waste
	Develop and implement sediment control plans at all quarries	Quarries with assistance from ODNR, Watershed Coordinator and partners; Existing resources	2010-2015	Water quality improvements; surface drainage or storm water basins
Restore natural flow regime to the river (where feasible)	Remove Batavia low-head dam	Watershed Coordinator, OEPA, Village of Batavia, local partners; OEPA 319, other similar grants	2010-2016	Restor natural flow, habitat—enhanced biocriteria/habitat scores (IBI, ICI, QHEI)
	Develop low-impact, volunteer log jam management program	Landowners, Watershed Coordinator, Clermont SWCD, Clermont County Engineers, and partners; Seek grants	2010-2015	Tools and tracking system to identify and remove log jams without degrading habitat
	Determine impacts of controlled release from Harsha Lake on flora/ fauna	Watershed Coordinator, Clermont SWCD, Army Corp. Engineers, partners; Seek funding	2010-2012	Study conducted on impacts of stream flow;

MANAGE WATER QUALITY AND QUANTITY				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORMANCE INDICATORS**
Maintain natural character of the landscape and rural livelihood	Promote land use planning, balanced growth and farmland preservation	Clermont County Planning Dept., local elected officials, zoning boards, land trusts Existing resources	Ongoing	Revised land use plans and zoning regulations; acres farmland preserved
	Participate in local Advanced Mitigation Work Group Assist with creation of Mitigation Project Bank by assessing, identifying potential projects Implement advanced mitigation projects	Watershed Coordinator, Clermont SWCD, Clermont OEQ & Storm Water, Clermont Co. Transportation Improvement District, landowners Existing resources	Ongoing	Mitigation Project Bank created with potential projects identified Updates to WAP implementation
Raise public awareness and foster watershed stewardship	Enlist Middle East Fork residents in existing rural and urban conservation programs and practices that protect water resources	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Clermont Health Dept., NRCS, FSA, local partners; Existing resources, grants	Ongoing	Numbers of active citizens, land owners; acreage land conserved/ preserved; miles stream/corridor protected
	Form permanent subcommittee of the East Fork Watershed Collaborative to monitor and assess watershed management	Develop clear monitoring and assessment goals for the watershed	2010	EFLMR M&A Team established Goals developed and documented
	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations ; Seek grant	2010-2015	East Fork citizen monitoring program
	Coordinate volunteer clean-up events Educational canoe floats Develop East Fork Adopt-a-Waterway program	Watershed Coordinator, Adams/Clermont Solid Waste District, Clermont SWCD, volunteers, partners; ODNR clean-up grants, similar grants	Ongoing	Miles of “Clean” streams; tons of garbage collected; Miles of “Adopted” waterway; # of participants

MANAGE WATER QUALITY AND QUANTITY (continued)				
OBJECTIVE	**ACTION**	**RESOURCES**	**TIME FRAME**	**PERFORMANCE INDICATORS**
Raise public awareness and foster watershed stewardship (continued)	Develop Watershed Awareness Survey to measure attitudes/behaviors/ interest in communities	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, local universities, partners; Existing resources (internship, thesis project), seek funding	2010-2011	Survey complete
	Media outreach and education: press releases, articles	Watershed Coordinator, EF M&A Team, Clermont SWCD, Clermont OEQ	Ongoing	Articles published, news stories
	Produce newsletters, field days Produce reports on watershed activities Produce outreach materials related to watershed protection (septic maintenance, fertilizer use, etc…)	Watershed Coordinator, SWCDs, OSU Extension, Farm Bureau and all EFWC partners	Ongoing	Newsletter reports, Minimum 2 field days/ workshops each year Outreach materials developed and distributed to target audiences

HUC-14: 05090202-120-030 and 040

East Fork Little Miami River Mainstem (East Fork Lake to Stonelick Creek)
OEPA Stream Code: 11-100
Drainage Area: 37.8 mi^2
Use Designation: EWH

Background

According to Ohio EPA, portions of the East Fork Little Miami River [HUC 14: 05090202-120-030 and 040; Ohio EPA Stream Code: 11-100], from its inception at river mile 20.5 (below Harsha Dam) to the confluence with Stonelick Creek at river mile 8.8, are not fully meeting its water quality use designation. This assessment unit includes a mixture of residential and commercial land use, forest cover, and some non-irrigated crop production. The Villages of Batavia and Amelia are located within the assessment unit. There is one lowhead dam located in Batavia at RM (14.0). Stream flow is regulated by the US Army Corps of Engineers at Harsha Dam. A minimum stream flow of 30 cfs (cubic feet per second) is maintained throughout the year.

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that flow alteration and high nutrient levels and flow alteration were resulting in impaired use attainment. The primary impairment were notes as modified flow-development, municipal point sources, non-point source urban runoff (i.e., impervious surface runoff, stormwater), and non-irrigated crop production.

Aerial photographs show that the majority of the mainstem has sufficient riparian protection and is dominated by forest cover. The width of riparian zones ranges from 50 to 800 feet, with sections narrowing through areas of increased development. Sections of unprotected stream are sparse and are primarily located in urbanized areas and along sections of river that are in close proximity to a residence or roadway (Euclid Road and State Route 222).

Due to the upstream location of Harsha Lake, it is difficult to model total loadings for the mainstem, as the lake provides a sink for sediments and nutrients. In the absence of an appropriate model, a LSPC model was calculated for the Middle East Fork to gain a general understanding of current loadings and potential impacts to the river. These estimates are based on existing water quality and land use data. In the future, a lake model will need to be performed to accurately capture existing loads and to determine allowable loadings into the Middle East Fork.

According to LSPC estimates the total nitrogen and phosphorus loads for the East Fork mainstem (RM 20.5 to RM 8.8) are estimated to be 378 and 95 tons per year, respectively. Based on existing and allowable load results from modeled streams in the East Fork watershed it is estimated that a 50% reduction in nitrogen and phosphorous is needed to meet Ohio EPA allowable loads. The primary sources for these nutrients are municipal point sources, non-point source urban runoff (i.e., impervious surface runoff, stormwater), and non-irrigated crop production.

The LSPC model predicts that the total sediment load for the East Fork mainstem (RM 20.5 to RM 8.8) is 5,500 tons per year. The primary sources of sediment are bank erosion and non-point urban runoff. Based on estimated loadings results from the LSPC model no reductions are needed in Total Suspended Solids (TSS). According to model results the entire Middle East Fork watershed is meeting Ohio EPA allowable loadings for TSS, due to the presence of Harsha Lake.

The following statements and action tables have been developed to address the high levels of nutrients and flow alterations occurring in the EFLMR mainstem.

Problem Statement #1

Municipal point sources, non-point source urban runoff, non-irrigation crop production are contributing 378 tons of nitrogen and 95 tons of phosphorus to the EFLMR each year.

Goal

To reduce nitrogen and phosphorus loadings by 50% to reach full attainment of the aquatic life use designation for the mainstem.

Objectives

1. Reduce nitrogen loadings from point sources (RM 20.5 to RM 8.8) by 189 tons per year.
2. Reduce nitrogen loadings from nonpoint sources (RM 20.5 to RM 8.8) by 189 tons per year.
3. Reduce phosphorus loadings from point sources (RM 20.5 to RM 8.8) by 48 tons per year.
4. Reduce phosphorus loadings from nonpoint sources (RM 20.5 to RM 8.8) by 48 tons per year.
5. Maintain or reduce total suspended solids (TSS) loadings from point and non-point sources (RM 20.5 to RM 8.8); not to exceed 5500 tons per year.
6. Increase public awareness and participation in watershed protection

East Fork Little Miami River: Problem Statement #1				
Objective	**Action**	**Resources Costs**	**Time Frame**	**Performance Indicators**
Reduce nitrogen loadings by 189 tons/yr from point sources	Implement effective WTP technologies and monitoring to reduce pollutants	OEPA, Clermont County Wastewater, Clermont OEQ, partners; Low interest loans, cost-share for WWTP upgrades	Ongoing	Meet NPDES permit limits Improve water quality
	Draft and implement regulations for registration and testing of septic haulers, and proper application or disposal of septage	OEPA, Clermont County Health District, Watershed Coordinator, partners; Existing resources	Ongoing	Eliminate reports of illicit discharges or improper handling of septic waste
Reduce nitrogen loadings by 189 tons/yr from nonpoint sources	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Protect 25% (3.5 mi/50ft width) of riparian corridor (mainstem) through land purchase or conservation easement Riparian enhancements	Watershed Coordinator, Clermont SWCD, Clermont OEQ, Clermont Park District, landowners, partners; WRRSP, CRP, CREP, related programs; Estimate: Fee simple = Floodway land = $8,000 ac; Riparian tree plantings = $14-20,000	2010-2015	Reduce nitrogen loadings by 163 lb/yr
	Repair or replace 100 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $1,200,000 ($10-12,000 per system)	2010-2018	Reduce nitrogen loadings by 2,529 lbs/yr Educational materials for homeowners, realtors, developers

East Fork Little Miami River: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce nitrogen loadings by 189 tons/yr from nonpoint sources (continued)	Establish 200 acres of filter strips/streambank protection on row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP Estimate: \$135/ac + \$100 (incentive payment) + \$95 (rental rate) (over 10 yrs) = \$28,950	Ongoing	Reduce nitrogen by 1800 lb/yr
	Implement conservation tillage, cover crops, nutrient management practices on estimated 800 acres of agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP Estimate: cons. tillage \$8 ac x 800 ac = \$6,400; cover crops \$15 ac = \$12,000; nutrient mgmt practices \$5 ac = \$4,000	Ongoing	Reduce nitrogen by 2 tons/yr
	Establish Waste Storage Facilities for 20% of horse and cattle livestock operations	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; EQIP, related programs Estimate: 7 horse operations \$1.33 ft^3 x 800 ft^3 (avg. 4 horses) = \$1,064 x 15 = \$15,960 Est. cost: 4 cattle operations:\$2.43 ft^3 x 3,000 ft^3 (avg. 15 cattle) = \$7,290	Ongoing	Calculate load reductions with Step L

East Fork Little Miami River: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce nitrogen loadings by 189 tons/yr from non-point sources (continued)	Implement urban BMP's: Install: 10 bioretention cells/ rain gardens; 80 rain barrels; Install/retrofit Demonstration green roof and permeable pavement	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/ rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.; green roof = $9-16 per sq. ft. (extensive), $17-33 per sq. ft. (intensive); permeable pavement = $3-7 per sq ft.	2010-2018	Impervious surfaces <10% in watershed Demonstration projects Estimate nitrogen load reductions using Step L
	Implement Low Impact Development	Watershed Coordinator, Clermont SWCD, Clermont Planning Dept., partners; Existing resources, seek funding	2010-2018	Develop one LID demonstration in watershed Impervious surfaces <10% in watershed Determine load reductions using Step L
Reduce phosphorus loadings from point sources by 48 tons/ yr	Implement effective WTP technologies and monitoring to reduce pollutants	OEPA, Clermont County Wastewater, Clermont OEQ, partners; Low interest loans, cost-share for WWTP upgrades	Ongoing	Meet NPDES permit limits Improved water quality
	Draft and implement regulations for registration and testing of septic haulers, and proper application or disposal of septage	OEPA, Clermont County Health District, Watershed Coordinator, partners; Existing resources	Ongoing	Eliminate reports of illicit discharges or improper handling of septic waste (average of 2 reports each year)

East Fork Little Miami River: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus loadings from non-point sources by 48 tons/yr	Draft and adopt riparian set-back ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Protect 25% of riparian corridor (mainstem) through land purchase or conservation easement Riparian enhancements (tree plantings)	Watershed Coordinator, Clermont SWCD, Clermont OEQ, Clermont Park District, landowners, partners; WRRSP, CRP, CREP, related programs; Estimate: Fee simple = Floodway land = $8,000 ac; Riparian tree plantings = $14-20,000	2010-2015	Reduce phosphorus loadings by 72 lbs/yr
	Repair or replace 100 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $1,200,000 ($10-12,000 per system)	2010-2018	Reduce phosphorus by 958 lbs/yr Educational materials for homeowners, realtors, developers
	Establish 200 acres of filter strips/ streambank protection on row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP, existing programs/resources Estimate: $135 ac + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) = $28,950	Ongoing	Reduce phosphorus by 800 lbs/yr
	Implement conservation and nutrient management on 800 acres row-crop land	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CREP, CRP, EQIP Estimate: cons. tillage $8 ac x 800 ac = $6,400; cover crops $15 ac = $12,000; nutrient mgmt practices $5 ac = $4,000	Ongoing	Reduce phosphorus by 1600 lbs/yr Acres of farmland enrolled

East Fork Little Miami River: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus loadings from non-point sources by 48 tons/yr (continued)	Establish Waste Storage Facilities for 20% of small-scale livestock operations	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; EQIP, related programs Estimate: 15 horse operations $1.33 ft^3 x 800 ft^3 (avg. 4 horses) = $1,064 x 15 = $15,960 Estimate: 5 cattle operations:$2.43 ft^3 x 3,000 ft^3 (avg. 14 cattle) = $7,290	Ongoing	Calculate load reductions with Step L
	Implement urban BMP's: Install: 5 bioretention cells/rain gardens; 100 rain barrels; Install/retrofit Demonstration green roof and permeable pavement	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.; green roof = $9-16 per sq. ft. (extensive), $17-33 per sq. ft. (intensive); permeable pavement = $3-7 per sq ft.	2010-2018	Impervious surfaces <10% in watershed Demonstration projects Estimate phosphorus load reductions using Step L
	Implement Low Impact Development	Watershed Coordinator, Clermont SWCD, Clermont Planning Dept., partners; Existing resources, seek funding	2010-2018	Develop 1 Low Impact Demonstration Development Determine load reductions using Step L
Maintain/ reduce total suspended solids (TSS) loadings from point sources	Implement effective WTP technologies and monitoring to reduce pollutants	OEPA, Clermont County Wastewater, Clermont OEQ, partners; Low interest loans, cost-share for WWTP upgrades	Ongoing	Meet NPDES permit limits Improved water quality

East Fork Little Miami River: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Maintain/ reduce total suspended solids (TSS) loadings from point sources (continued)	Draft and implement regulations for registration and testing of septic haulers, and proper application or disposal of septage	OEPA, Clermont County Health District, Watershed Coordinator, partners; Existing resources	Ongoing	Eliminate reports of illicit discharges or improper handling of septic waste (average of 2 reports each year)
Maintain/ reduce total suspended solids (TSS) loadings from non-point sources	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Protect 25% of riparian corridor (mainstem) through land purchase or conservation easement Riparian enhancements (tree plantings)	Watershed Coordinator, Clermont SWCD, Clermont OEQ, Clermont Park District, landowners, partners; WRRSP, CRP, CREP, related programs; Estimate: Fee simple = Floodway land = $8,000 ac; Riparian tree plantings = $14-20,000	2010-2015	Reduce TSS loadings by 55 tons/yr
	Repair or replace 100 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $1,200,000 ($10-12,000 per system)	2010-2018	Reduce TSS by 4599 lb/yr
	Establish filter strips on 200 acres of row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, LMRP, local partners; CRP, EQIP, CREP,existing programs/resources Estimate: $135 ac + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) = $28,950	Ongoing	Reduce TSS by 600 tons/yr

East Fork Little Miami River: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Maintain/ reduce total suspended solids (TSS) loadings from non-point sources (continued)	Implement conservation tillage, cover crops, nutrient management practices on estimated 800 acres of agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP Estimate: cons. tillage $8 ac x 800 ac = $6,400; cover crops $15 ac = $12,000; nutrient mgmt practices $5 ac = $4,000	Ongoing	Reduce TSS by 1600 tons/yr Acres of farmland enrolled
	Implement urban BMP's: Install: 5 bioretention cells/rain gardens; 100 rain barrels; Install/retrofit Demonstration green roof and permeable pavement	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.; green roof = $9-16 per sq. ft. (extensive), $17-33 per sq. ft. (intensive); permeable pavement = $3-7 per sq ft.	2010-2018	Impervious surfaces <10% in watershed Demonstration projects Estimate nitrogen load reductions using Step L
	Implement Low Impact Development	Watershed Coordinator, Clermont SWCD, Clermont Planning Dept., partners; Existing resources, seek funding	2010-2018	Develop one LID in watershed Determine load reductions Step L

East Fork Little Miami River: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Increase public awareness and participation in watershed protection	Enlist Middle East Fork residents in existing rural and urban conservation programs practices that protect water resources	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Clermont Health Dept., NRCS, FSA, local partners; Existing resources and program grants	Ongoing	Number active citizens, land owners; acreage land conserved/preserved; miles of stream/ corridor protected
	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs, organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	East Fork citizen monitoring program
	Coordinate volunteer clean-up events Host educational canoe floats Develop East Fork Adopt-a-Waterway program	Watershed Coordinator, Adams/ Clermont Solid Waste District, Clermont SWCD, volunteers, partners, schools; ODNR clean-up grants, similar grants	Ongoing	Miles of "Clean" streams; tons of garbage collected; Miles of "Adopted" waterway; # of events and participants
	Develop Watershed Awareness Survey to measure attitudes/ behaviors/interest in communities	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, partners; Existing resources, grants	2010-2011	Survey complete
	Media outreach and education: press releases, articles	Watershed Coordinator, EF M&A Team, Clermont SWCD, Clermont OEQ	Ongoing	Articles published, news stories broadcast
	Produce newsletters, field days, public meetings Produce reports on watershed activities Produce outreach materials related to watershed protection (septic maintenance, fertilizer use, etc…)	Watershed Coordinator, SWCDs, OSU Extension, Farm Bureau and all EFWC partners	Ongoing	Newsletter reports, Minimum 2 field days/workshops each year Outreach materials developed and distributed to target audiences

Problem Statement #2

The Harsha Lake Dam, Batavia low-head dam and nonpoint source urban runoff are altering the natural flow regime of the East Fork mainstem.

Goal

To restore the natural flow regime and reach full attainment of the Exceptional Warm Water Habitat aquatic life use designation for 11.7 miles of the mainstem.

Objectives

1. Develop low-head dam removal plan
2. Conduct a flow release study for Harsha Dam
3. Develop volunteer-based log-jam removal program
4. Increase public awareness and participation in watershed protection

East Fork Little Miami River: Problem Statement #2				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Develop low-head dam removal plan	Perform sediment survey behind dam	Watershed Coordinator, OEPA, Village of Batavia, local partners; Existing resources, seek funding	2010-2018	Sediment report
	Meet with Village Council and stakeholders Develop plan for dam removal	Watershed Coordinator, OEPA, Village of Batavia, Consultants, local partners; OEPA 319 grant, similar grants	2010-2012	Lowhead dam removed Restore natural flow, floodplain connectivity Improved biocriteria/ habitat scores (IBI ≥ 50, ICI ≥ 46, QHEI ≥ 70)
Conduct flow release study for Harsha Dam	Conduct bio-inventory of sensitive/intolerant species Determine impacts of flow release on sensitive spp.	Watershed Coordinator, OEPA, US. Army Corp. Engineers, Clermont OEQ, partners; Seek funding: $25,000	2012-2018	List of impacted species Study complete
Develop volunteer-based log-jam removal plan	Identify areas prone to log jams Develop volunteer reporting and response program for removal	Landowners, Watershed Coordinator, Clermont SWCD, Clermont County Engineers, partners; Seek funds	Ongoing	GIS layer with target areas Develop reporting system and volunteer response team

East Fork Little Miami River: Problem Statement #2 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Increase public awareness and participation in watershed protection	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	Establish effective citizen monitoring program in East Fork Collect data pertaining to flow alterations
	Coordinate volunteer clean-up events Host educational canoe floats Develop East Fork Adopt-a-Waterway program	Watershed Coordinator, Adams/Clermont Solid Waste District, Clermont SWCD, volunteers, partners, schools; ODNR clean-up grants, similar grants	Ongoing	Hold at least 1 Clean-up events; 1 educational canoe float each year Record: - miles of “Clean” streams -tons of garbage collected -miles of “Adopted” waterway -# of participants
	Develop Watershed Awareness Survey to measure attitudes/ behaviors/interest in dam removal and log jam removal program	Watershed Coordinator, Clermont SWCD, partners; Existing resources, seek grants	2010-2011	Survey complete
	Media outreach and education: press releases, articles Produce newsletter, outreach materials	Watershed Coordinator, EF M&A Team, Clermont SWCD, Clermont OEQ	Ongoing	Publish informational pieces Produce/update outreach materials as needed

HUC-14: 05090202-120-030

Lucy Run
OEPA Stream Code: 11-116
Drainage Area: 7.25 mi^2
Use Designation: WWH

Background

Portions of Lucy Run [HUC 14: 05090202-120-030; OEPA Stream Code: 11-116], a tributary to the East Fork Little Miami River, are not fully meeting the WWH water quality use designation. The entire length of Lucy Run (2.4 miles) was assessed in 1998 by Ohio EPA. During the assessment 41.7% (1.0 river miles) was in “Full, but Threatened” status, another 41.7% (1.0 river miles) in “Partial” attainment, while the remaining 16.6% (0.4 river miles) did not support its WWH use designation. This assessment unit is dominated by forested land cover and has 8% impervious surface cover; the watershed is facing pressure from future development.

Lucy Run is classified as a B4c stream, according to the Rosgen Stream Classification System (Tetra Tech, Inc., 2001). This classification indicates the stream is a stable, moderately entrenched step-pool system with low sinuosity, large riparian areas and a slope of less than 2 percent. Aerial photographs show adequate riparian protection throughout the middle portion of the stream, to its confluence with the East Fork. The upper reaches, however, have little to no riparian protection against the surrounding agricultural land use. There is approximately 2,200 linear feet of stream with no streambank vegetation.

In its 2000 Ohio Water Resource Inventory, Ohio EPA reported that elevated nutrient levels and habitat loss are causing biological impairment in Lucy Run. Habitat modifications and development are the primary sources of impairment in this urbanizing watershed. Highly elevated bacterial parameters indicate raw sewage inputs from unknown sources. A sewer line runs through the stream channel in the middle portion of this stream. Aquatic life use attainment was restricted to the lower reach of the stream near the mouth.

The LSPC model predicted that the total suspended sediment (TSS) load for the assessment unit is 254 tons per year. According to LSPC model predictions no reductions in TSS is needed to meet allowable loads.

The LSPC model predicted existing phosphorous loads at 2 tons per year and nitrogen loads at 50 tons per year. Phosphorus would need to be reduced by 75% and nitrogen by 60% to meet Ohio EPA allowable loads.

Problem Statement #1

Habitat alterations and other unidentified sources are contributing 2 tons of phosphorus and 50 tons of nitrogen each year, impairing the aquatic life use designation for Lucy Run

Goal:

The goal is to reduce phosphorus by 75%, nitrogen by 60% and minimize land use impacts to reach full attainment of the aquatic life use for Lucy Run.

Objectives

1. Reduce nitrogen loadings from agriculture by 30 tons per year
2. Reduce nitrogen loadings from urban runoff by 30 tons per year
3. Reduce phosphorous loadings from agriculture by 1.5 tons per year
4. Reduce phosphorus loadings from urban runoff by 1.5 tons per year
5. Increase public awareness and participation in watershed protection

Lucy Run: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce nitrogen loadings from agriculture by 30 tons/ yr	Protect 2,200 linear feet riparian/streambank corridor (50' width) with conservation easement or land purchase; restore riparian vegetation	Landowners, Watershed Coordinator, Clermont SWCD, NRCS, FSA, partners; CRP, CREP, EQIP, WRRSP related programs Estimate: $8,000 per acre easement/purchase floodway Riparian restoration/tree planting: $10,000	2010-2015	Reduce nitrogen by 23 lb/yr
	Repair or replace 25 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $300,000 ($10-12,000 per system)	2010-2018	Reduce nitrogen loadings by 632 lbs/ yr Educational materials for homeowners, realtors, developers
	Implement conservation tillage, cover crops, nutrient management practices on estimated 200 acres of agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP Estimate: cons. tillage $8 ac x 200 ac = $1,600; cover crops $15 ac = $3,000; nutrient mgmt practices $5 ac = $1,000	Ongoing	Reduce nitrogen by 800 lbs/yr

Lucy Run: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce nitrogen loadings from agriculture by 30 tons/yr (continued)	Implement filter strips on 200 acres of row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, related programs Estimate $135 ac + $100 (incentive payment) + $95 (rental rate) = $28,000	Ongoing	Reduce nitrogen loadings by 1800 lbs/yr
Reduce nitrogen loadings from urban runoff by 30 tons/yr	Implement urban BMP's: Install: 2 bioreten-tion cells/ rain gar-dens; 100 rain barrels; Install demonstra-tion perme-able pave-ment	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.; green roof = $9-16 per sq. ft. (extensive), $17-33 per sq. ft. (intensive); Permeable pavement parking lot = $3-7 per sq ft.	2010-2018	Impervious surfaces <10% in watershed Demonstration pro-jects Estimate nitrogen load reductions us-ing Step L
	Draft and adopt ri-parian set-back ordi-nance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, part-ners; Existing Resources	2010-2015	Implemented ripar-ian setbacks, mini-mum of 35 feet

Lucy Run: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus loadings from agriculture by 1.5 tons/yr	Protect 2,200 linear feet riparian/ streambank corridor (50' width) with conservation easement or land purchase; restore riparian vegetation	Landowners, Watershed Coordinator, Clermont SWCD, NRCS, FSA, partners; CRP, CREP, EQIP, WRRSP related programs Estimate: $8,000 per acre easement/purchase floodway Riparian restoration/tree planting: $10,000	2010-2015	Reduce phosphorus by 10 lb/yr
	Repair or replace 25 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $300,000 ($10-12,000 per system)	2010-2018	Reduce phosphorus by 239 lbs/yr Educational materials for homeowners, realtors, developers
	Implement filter strips on 200 acres of row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, related programs Estimate $135 ac + $100 (incentive payment) + $95 (rental rate) = $28, 950	Ongoing	Reduce phosphorus by 800 lbs/yr
	Implement conservation and nutrient management on 200 acres row-crop land	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CREP, CRP, EQIP Estimate: cons. tillage $8 ac x 200 ac = $1,600; cover crops $15 ac = $3,000; nutrient mgmt practices $5 ac = $1,000	Ongoing	Reduce phosphorus by 400 lbs/yr Acres of farmland enrolled

Lucy Run: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus loadings from urban runoff by 1.5 tons/yr	Implement urban BMP's: Install: 2 bioretention cells/rain gardens; 100 rain barrels; Install demonstration permeable pavement	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.; permeable pavement parking lot = $3-7 per sq ft.	2010-2018	Impervious surfaces <10% in watershed Demonstration projects Estimate nitrogen load reductions using Step L
	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/ Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
Increase public awareness and participation in watershed protection	Enlist Middle East Fork residents in existing rural and urban conservation programs and practices that protect water resources	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Clermont Health Dept., NRCS, FSA, local partners; Existing resources and program grants	Ongoing	Numbers of active citizens, land owners; acreage land conserved/ preserved; miles of stream/corridor protected

Lucy Run: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Increase public awareness and participation in watershed protection (continued)	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	East Fork citizen monitoring program
	Coordinate volunteer clean-up events Host educational canoe floats Develop East Fork Adopt-a-Waterway program	Watershed Coordinator, Adams/Clermont Solid Waste District, Clermont SWCD, volunteers, partners, schools; ODNR clean-up grants, similar grants	Ongoing	Hold at least 1 Clean-up events; 1 educational canoe float each year Record: - miles of "Clean" streams -tons of garbage collected -miles of "Adopted" waterway -# of participants
	Develop Watershed Awareness Survey to measure attitudes/ behaviors/ interest in communities	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, partners; Existing resources, seek grants	2010-2011	Survey complete
	Produce newsletters, field days, public meetings Produce reports on watershed activities Produce outreach materials	Watershed Coordinator, SWCDs, OSU Extension, Farm Bureau and all EFWC partners	Ongoing	Newsletter reports, Minimum 2 field days/ workshops each year Outreach materials developed and distributed to target audiences

Problem Statement #2

Unidentified sources are contributing undetermined amounts of raw sewage each year, impairing the aquatic life use designation of Lucy Run.

Goal:

To eliminate sewage contamination to reach full attainment of the aquatic life use designation for Lucy Run

Objective

1. Identify and contain sources of sewage contamination
2. Increase public awareness and participation in watershed protection

Lucy Run: Problem Statement #2				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Identify and contain sources of sewage contamination	Site inspections of sewer line Conduct water monitoring	Watershed Coordinator, Clermont Sewer/Water, Clermont OEQ, partners Existing Resources	2009-2012	Locate sources of sewage contamination Collect water quality samples, analyze for E.coli, fecal colifrom Implement plan to eliminate any identified spills/ leaks
	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	Establishment of effective citizen monitoring program for Lucy Run; Collect, analyze and distribute data for E.coli and fecal coliform
	Repair or replace 25 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $300,000 ($10-12,000 per system)	2010-2018	Reduce E.coli and fecal coliform to EPA allowable WWH standards

Lucy Run: Problem Statement #2				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Increase public awareness and participation in watershed	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	East Fork citizen monitoring program
	Develop an effective HSTS homeowner education program	Clermont Health District, Watershed Coordinator and partners;	2010-2015	Increase # of properly working HSTS
	Develop Watershed Awareness Survey to measure attitudes/behaviors	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, partners; Existing resources, grants	2010-2011	Survey complete
	Media outreach and education: press releases, articles Produce newsletter, outreach materials	Watershed Coordinator, EF M&A Team, Clermont SWCD, Clermont OEQ	Ongoing	Publish at least 1 informational piece Produce/update outreach materials as needed

HUC-14: 05090202-120-030

Fourmile Run
OEPA Stream Code: 11-117
Drainage Area: 3.58 mi^2
Use Designation: WWH

Background

Fourmile Run [HUC-14: 05090202-120-030; OEPA Stream Code: 11-117], a tributary to the East Fork Little Miami River (EFLMR), is not fully meeting its WWH use designation. The stream is 6.35 miles in length, of which 20% (1.3 miles) are in "Partial" attainment, while another 20% (1.3 miles) are not attaining the aquatic life use designation. The remaining 60% (3.75 miles) have not been assessed.

Fourmile Run originates from an onsite drainage pond located at the Batavia Ford Motor Plant, which was built in 1980 and is currently in the process of closing down. The plant poses no significant threat to the health of the stream; any changes that occur at this site will be monitored to determine potential future impacts.

The land use in the Fourmile Run watershed is dominated by forest cover. The headwaters of this assessment unit are surrounded by row crop agriculture, with a mixture of low-intensity residential and commercial/industrial development. Aerial photographs show that Fourmile Run has sufficient riparian protection in the upper part of the watershed. However, the stream lacks adequate riparian protection in the lower section along the .8 mile (4,224 linear ft) stretch adjacent to the Elk Run Golf Course, down to its confluence with the East Fork. There is approximately 150 feet of channelized stream in this stretch.

In its 2000 Ohio Water Resources Inventory, Ohio EPA reported that during the 1997 assessment Fourmile Run had a heavy bedload of silt and sand. Siltation and habitat alterations were listed as the causes of impairment; land development, suburbanization, and channelization were noted as the sources of impairment. Clermont County data also revealed elevated levels of suspended sediments, along with elevated levels of phosphorus. These data reflect the problems that occurred from the construction of the Elk Run Golf Course, during which there were no effective erosion and stormwater controls in place. Erosion continues to be an issue in this section of stream, however nutrient and pesticide runoff are currently the main contributors of impairment.

The LSPC model predicted existing nitrogen and phosphorous loads at <2 tons per year and <1 ton per year. A 25% reduction in nitrogen is needed to meet allowable loadings and only a 5% reduction is needed for phosphorous.

The LSPC model predicted existing total suspended solids (TSS) at 95 tons per year. No reduction is needed to meet allowable loads for TSS.

As noted in the Ch. 2 Watershed Inventory, the Bob McEwen Drinking Water Treatment Plant occasionally discharges into Fourmile Run when it flushes the plant's drainage system. Elevated levels of fluoride have been documented, however the potential impacts to the stream have yet to be assessed.

Problem Statement

Land development, suburbanization and channelization are altering habitat and contributing <2 tons of nitrogen and <1 ton of phosphorus to Fourmile Run each year.; these factors are impairing the aquatic life use designation of the stream.

Goal

The goal is to reduce phosphorus loadings by 5%, nitrogen loadings by 25%, maintain or reduce TSS loadings and minimize the impact of surrounding land uses to reach full attainment of the aquatic life use designation for Lucy Run.

Objectives:

1. Reduce phosphorus loadings from urban runoff and agriculture by 2,000lbs/year
2. Reduce nitrogen loadings from agriculture and urban runoff by 4,000 lbs/year
3. Determine morphological and stream stability status of Fourmile Run
4. Increase public awareness and participation in watershed protection

Fourmile Run: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus loadings from urban runoff by 2,000 lb/ year	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Protect/restore 4,224 linear feet of riparian corridor with conservation easement or purchase (50' buffer); Restore 150 ft channelized stream using Natural Channel Design	Landowners, Watershed Coordinator, Clermont SWCD, partners CRP, EQIP, WRRSP, related programs Estimate: Easement/purchase = $8, 000 per acre; Riparian tree planting = $18-30,000; NCD restoration $200-300/ linear ft	2010-2015	Calculate load reductions with Step L

Fourmile Run: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus loadings from urban runoff by 2,000 lb/ year (continued)	Implement urban BMP's: Install: 2 bioretention cells/rain gardens; 100 rain barrels;	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.;	2010-2018	Impervious surfaces <10% in watershed Estimate nitrogen load reductions using Step L
Reduce phosphorus from agriculture by 2,000 lb/yr	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Establish filter strips on 200 acres strips of row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP, existing resources Estimate: $135 ac + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) = $28,950	Ongoing	Reduce phosphorus by 800 lbs/yr
	Implement conservation tillage, cover crops, nutrient management practices on estimated 200 acres of agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CREP, CRP, EQIP Estimate: cons. tillage $8 ac x 200 ac = $1,600; cover crops $15 ac = $3,000; nutrient mgmt practices $5 ac = $1,000	Ongoing	Reduce phosphorus by 400 lbs/yr Acres of farmland enrolled

Fourmile Run: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce phosphorus from agriculture runoff by 2,000 lbs/yr (continued)	Protect/restore 4,224 linear feet of riparian corridor with conservation easement or purchase; Restore 150 ft channelized stream using Natural Channel Design	Landowners, Watershed Coordinator, Clermont SWCD, partners CRP, CREP, EQIP, WRRSP, related programs Estimate: Easement/ purchase = $2,000—$5,000 per acre; Riparian tree planting = $18-30,000; NCD restoration $200-300/ linear ft	2010-2015	Calculate phosphorous reductions with Step L
	Repair or replace 15 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $180,000 ($10-12,000 per system)	2010-2018	Reduce phosphorus by 143 lbs/yr Educational materials for homeowners, realtors, developers
Reduce nitrogen from urban runoff by 4,000 lb/yr	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/ Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Protect/restore 4,224 linear feet of riparian corridor with conservation easement or purchase; Restore 150 ft channelized stream using Natural Channel Design	Landowners, Watershed Coordinator, Clermont SWCD, partners CRP, CREP, EQIP, WRRSP, related programs Estimate: Easement/ purchase = $2,000—$5,000 per acre; Riparian tree planting = $18-30,000; NCD restoration $200-300/ linear ft	2010-2015	Calculate nitrogen reductions using Step L

Fourmile Run: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce nitrogen from urban runoff by 4,000 lb/yr (continued)	Implement urban BMP's: Install: 2 bioretention cells/rain gardens; 10 rain barrels;	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.;	2010-2018	Impervious surfaces <10% in watershed Demonstration projects Estimate nitrogen load reductions using Step L
Reduce nitrogen from agricultural runoff by 4,000 lb/yr	Protect/restore 4,224 linear feet of riparian corridor with conservation easement or purchase; Restore 150 ft channelized stream using Natural Channel Design	Landowners, Watershed Coordinator, Clermont SWCD, partners CRP, CREP, EQIP, WRRSP, related programs Estimate: Easement/purchase = $2,000—$5,000 per acre; Riparian tree planting = $18-30,000; NCD restoration $200-300/linear ft	2010-2015	Reduce phosphorus by 1480 lbs/yr
	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet
	Establish filter strips on 200 acres strips of row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP; Estimate: $135 ac + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) = $28,950	Ongoing	Reduce nitrogen by 216 lbs/yr

Fourmile Run: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce nitrogen from agricultural runoff by 4,000 lb/yr (continued)	Implement conservation tillage, cover crops, nutrient management practices on estimated 200 acres of agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, local partners; CREP, CRP, EQIP Estimate: cons. tillage $8 ac x 200 ac = $1,600; cover crops $15 ac = $3,000; nutrient mgmt practices $5 ac = $1,000	Ongoing	Reduce nitrogen by 800 lbs/yr
	Repair or replace 15 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $180,000 ($10-12,000 per system)	2010-2018	Reduce nitrogen loadings by 379 lbs/yr Educational materials: homeowners, realtors, developers
Determine morphological and stream stability status of Fourmile Run	Conduct physical/ morphological stream assessment using Rosgen Level III assessment, or QHEI assessments, or equivalent	Watershed coordinator, or qualified evaluator/consultant; Seek funding, grants	2010-2012	Physical and morphological assessment completed and reported in technical support document Complete 4 QHEI's each year

Fourmile Run: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Increase public awareness and participation in watershed protection	Enlist Middle East Fork residents in existing rural and urban conservation programs and practices that protect water resources	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Clermont Health Dept., NRCS, FSA, local partners; Existing resources and program grants	Ongoing	Numbers of active citizens, land owners; acreage land conserved/ preserved; miles of stream/corridor protected
	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	East Fork citizen monitoring program
	Coordinate volunteer clean-up events Host educational canoe floats Develop East Fork Adopt-a-Waterway program	Watershed Coordinator, Adams/Clermont Solid Waste District, Clermont SWCD, volunteers, partners, schools; ODNR clean-up grants, similar grants	Ongoing	Hold at least 1 Clean-up events; 1 educational canoe float each year Record: - miles of "Clean" streams -tons of garbage collected -miles of "Adopted" waterway -# of participants
	Develop Watershed Awareness Survey to measure attitudes/behaviors/ interest in communities	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, partners; Existing resources, grants	2010-2011	Survey complete
	Produce newsletters, field days, public meetings Produce reports on watershed activities Produce outreach materials	Watershed Coordinator, SWCDs, OSU Extension, Farm Bureau and all EFWC partners	Ongoing	Newsletter reports, Minimum 2 field days/workshops each year Outreach materials developed and distributed to target audiences

Problem Statement #2

Land development and suburbanization are increasing stormwater runoff and causing bank erosion in the Fourmile Run watershed.

Goal

To minimize the impacts of surrounding land use by maintaining impervious surface cover at or below 10% and stabilize eroding banks in the lower section of Fourmile Run by implementing stormwater BMPs.

Objectives

1. Implement land use controls to limit impervious surface cover at or below 230 acres
2. Control erosion by implementing urban and agricultural stormwater BMPs

Fourmile Run: Problem Statement #2				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Implement land use controls to limit impervious surface cover at or below 230 acres	Identify and protect critical open space, forested, and riparian areas.	Watershed Coordinator, Clermont SWCD, Clermont Stormwater, Clermont Park District, partners WRRSP, Clean Ohio, other similar grants/funding	2010-20018	Total area of impervious surface at or below 10%; Acres of protected land Bank Stabilization Determine load reductions using Step L
	Implement demonstration projects: permeable pavement parking lot, green roof where applicable	Watershed Coordinator, Clermont SWCD, Clermont Stormwater, Clermont Planning Dept., partners; Seek funding Green roof = $9-16 per sq. ft. (extensive), $17-33 per sq. ft. (intensive); Permeable pavement = $3-7 per sq ft.	2010-2018	Total area of impervious surface at or below 10% Determine load reductions using Step L
	Draft and adopt riparian setback ordinance	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Townships/ Villages, partners Existing Resources	2010-2015	Implemented riparian setbacks, minimum of 35 feet

Fourmile Run: Problem Statement #2 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Implement urban and agricultural BMPs to reduce stormwater run-off	Install: 2 bioretention cells/rain gar-dens; 100 rain barrels;	Clermont SWCD, Clermont Storm Water, Watershed Co-ordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cu-bic ft.;	2010-2018	Demonstration projects Estimate load re-ductions using Step L or equiva-lent
	Establish filter strips on 200 acres strips of row-crop agricul-ture	Watershed Coordinator, Cler-mont SWCD, NRCS, FSA, LMRP, local partners; CREP, EQIP, existing pro-grams/resources Estimate: $135 ac + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) = $28,950	Ongoing	Reduce stormater erosion: TSS re-duced by 600 tons/yr
	Implement con-servation tillage, cover crops, nu-trient manage-ment practices on estimated 200 acres of agricul-ture	Watershed Coordinator, Cler-mont SWCD, NRCS, FSA, local partners; CRP, CREP, EQIP Estimate: cons. tillage $8 ac x 200 ac = $1,600; cover crops $15 ac = $3,000; nutrient mgmt practices $5 ac = $1,000	Ongoing	Reduce stormwa-ter erosion; re-duce TSS by 400 tons/yr

Problem Statement #3

The impacts of excess levels of fluoride and pesticides have not been studied in Fourmile Run

Goal

To determine the water quality and biological impacts that result from excess levels of fluoride and pesticides

Objectives

1. Conduct water quality biological monitoring in discharge area behind Bob McEwen Drinking Water Treatment Plant
2. Conduct water quality and biological monitoring upstream and downstream of Elk Run Golf

Fourmile Run: Problem Statement #3				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Conduct water quality and biological monitoring behind BMWTP	Chemical analysis Sample fish and macroinvertebrate communities	Watershed Coordinator, Clermont OEQ, BMWTP, OEPA, volunteer monitors; Existing resources	2010-2012	Water quality analysis, with IBI, ICI scores Draft recommendations based on findings Technical report included in WAP
Conduct water quality and biological monitoring upstream and downstream Elk Run	Test for pesticides Sample fish and macroinvertebrate communities	Watershed Coordinator, Clermont OEQ, BMWTP, OEPA, volunteer monitors; Existing resources	2010-2012	Water quality analysis, with IBI, ICI scores Draft recommendations based on findings Technical report included in WAP

HUC-14: 05090202-120-040

Backbone Creek
OEPA Stream Code: 11-115
Drainage Area: 8.55 mi^2
Use Designation: WWH

Background

Backbone Creek [HUC-14: 05090202-120-040; OEPA Stream Code: 11-115], a tributary to the East Fork Little Miami River (EFLMR), has not been assessed by the Ohio EPA or Clermont County. This assessment unit has a mixture of land uses including agriculture, forest, and low-intensity residential and commercial development. During the fall of 2006, a new storage facility was constructed near the confluence of Backbone Creek and the East Fork mainstem. Even though stormwater measures are in place, it will be important to monitor outputs into Backbone Creek from this impervious area.

Streams in Backbone Creek were classified as F streams, according the to Rosgen Level I classification system (Tetra Tech, Inc., 2001). This classification indicates that the stream is highly entrenched with high erosion rates. While the majority of the mainstem is protected with forested riparian buffers, protection diminishes as the stream runs through agricultural and low-intensity residential areas. There is approximately 2,000 noncontiguous linear feet lacking adequate riparian protection. The largest section of unprotected stream corridor is adjacent to Elmwood Road, where the surrounding land use is agricultural.

No formal assessments have been conducted in Backbone Creek by Ohio EPA or Clermont County prior to 2008. Suspected causes of impairment include excess nutrients and sediments from agriculture and general nonpoint surface runoff. Due to the absence of water quality, biological, and habitat quality data no accurate LSPC results could be determined. The increase in development and land use changes in this watershed make water quality monitoring and habitat assessments a top priority for Backbone Creek.

Problem Statement

No formal assessments have been conducted in Backbone Creek; however, general observations indicate that the stream is impacted by surrounding land use. The increase in development and changes in land use in and around the assessment unit make this tributary a priority for future streams assessments.

Goal

The goal is to determine the aquatic life use designation for Backbone Creek and minimize the impact of surrounding land uses.

Objectives

1. Determine aquatic life use with water quality and biological monitoring
2. Complete a morphological and stream stability assessment
3. Reduce volume and improve quality of storm water runoff
4. Increase public awareness and participation in watershed protection

Backbone Creek: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Determine stream condition with water quality and biological monitoring	Conduct monitoring water quality and biological - involve local volunteers	Watershed Coordinator, OEPA, Clermont OEQ, Citizen monitors	2009-2014	Water quality and biological criteria used to determine aquatic life use designation
Complete a morphological and stream stability assessment	Conduct physical and morphological assessment of each stream using Rosgen Level III assessment or equivalent	Watershed coordinator, or qualified evaluator/consultant; Seek funding/grants	2010-2014	Physical and morphological assessment completed and reported in technical support document
Reduce volume and improve quality of storm water runoff	Re-establish 2,000 linear feet of riparian buffer Maintain or enhance existing riparian corridor	Watershed Coordinator, Clermont SWCD, local partners; CRP, CREP; seek grants Estimate: 2.5 ac x $8,000 /ac = $20,000 + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) Riparian tree plantings= $13-25,000	2010-2015	Reduce phosphorus by 9.2 lbs/yr, nitrogen by 20.7 lbs/yr, reduce runoff volume Total miles of continuous riparian corridor
	Improve soil quality and infiltration through agriculture BMPs (No-till farming, cover crops) Increase number of farms using nutrient, conservation, cover crop management plan	Landowners with assistance from watershed coordinators and all partners, education and promotion; NRCS, FSA programs; seek grants	Ongoing	Contact list of landowners implementing BMP practices Number of acres under management plans

Backbone Creek: Problem Statement #1 (continued)				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Reduce volume and improve quality of storm water runoff (continued)	Implement urban BMP's: Install: 2 bioretention cells/ rain gardens; 100 rain barrels;	Clermont SWCD, Clermont Storm Water, Watershed Coordinator, Clermont OEQ, partners, Clermont SWCD rain garden grants, other programs; seek funding Estimate: Bioretention/rain garden = $7-27 per sq. ft.; rain barrels = $14-19 per cubic ft.;	2010-2018	Impervious surfaces <10% in watershed Demonstration projects Estimate nitrogen load reductions using Step L
	Establish filter strips on 200 acres of row-crop agriculture	Watershed Coordinator, Clermont SWCD, NRCS, FSA, LMRP, local partners; CREP, EQIP, existing programs/resources Estimate: $135/ ac + $100 (incentive payment) + $95 (rental rate) (over 10 yrs) = $28,950	Ongoing	Reduce runoff volume, nutrient loading: nitrogen by 1800 lbs/yr, phosphorus by 800 lbs/yr, TSS by 600 tons/yr
	Repair or replace 25 failing HSTS's Develop an effective homeowner education program	Clermont Health District, Watershed Coordinator and partners; Seek grants; Estimate = $300,000 ($10-12,000 per system)	2010-2018	Reduce nutrient runoff: nitrogen 632 lbs/ yr, phosphorus 239 lbs/yr, TSS 1149 lbs/ yr
	Draft and adopt riparian setback ordinances in	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, partners Existing Resources	2010-2015	Riparian setback ordinance adopted implement minimum 35 setback

Backbone Creek: Problem Statement #1				
Objective	**Action**	**Resources**	**Time Frame**	**Performance Indicators**
Raise public awareness and foster watershed stewardship	Enlist Middle East Fork residents in existing rural and urban conservation programs and practices that protect water resources	Watershed Coordinator, Clermont SWCD, Clermont Storm Water, Clermont Health Dept., NRCS, FSA, local partners; Existing resources and program grants	Ongoing	Numbers of active citizens, land owners; acreage land conserved/ preserved; miles of stream/corridor protected
	Develop citizen monitoring program— enlist and involve local volunteers	Watershed Coordinator, local programs and organizations (schools, Farm Bureau, environmental group etc…); seek water monitoring grant	2010-2015	East Fork citizen monitoring program
	Coordinate volunteer clean-up events Develop East Fork Adopt-a-Waterway program	Watershed Coordinator, Adams/Clermont Solid Waste District, Clermont SWCD, volunteers, partners, schools; ODNR clean-up grants, similar grants	Ongoing	Miles of “Clean” streams; tons of garbage collected; Miles of “Adopted” waterway; # of participants
	Media outreach and education: press releases, articles	Watershed Coordinator, EF M&A Team, Clermont SWCD, Clermont OEQ	Ongoing	Articles published, news stories
	Produce newsletters, field days, public meetings Produce reports on watershed activities Produce outreach materials	Watershed Coordinator, SWCDs, OSU Extension, Farm Bureau and all EFWC partners	Ongoing	Newsletter reports, Minimum 2 field days/workshops each year Outreach materials developed and distributed to target audiences

Middle East Fork Watershed Action Plan

APPENDICES

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East Fork
WATERSHED COLLABORATIVE

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APPENDIX A
Summary of Previous and Current Water Quality Efforts in the East Fork Little Miami River Watershed

History of Previous Water Quality Efforts in the Watershed

Upper East Fork, Little Miami River 319 Nonpoint Source Project

In 1991 the Soil and Water Conservation District's of Brown, Clinton, and Highland Counties received a Nonpoint Source Project Grant (319) for the headwaters region of the East Fork of the Little Miami River. The duration of the project was for 36 months beginning in April 1992 and ending in March 1995. The goal of the project was to accelerate technical assistance and educational activities to improve water quality and warmwater habitat in the project watershed. The project sponsors focused on five specific objectives to reach the project goal;

1. Protect and improve water quality in the East Fork of the Little Miami River.
2. Reduce sedimentation and nutrient loading to the East Fork Reservoir.
3. Increase cooperation between health departments, agricultural agencies and other public and private groups in identifying and solving non-point source problems.
4. Monitor existing stream quality to establish baseline data for future comparison to determine effectiveness of the project.
5. Educate health department's employees on use of soils information in designing on-site wastewater treatment systems.

Clermont County 319 Nonpoint Source Project

In 1998 the Clermont County Board of County Commissioners received a Nonpoint Source Project Grant (319) to perform bank stabilization in a section of Stonelick Creek. Stonelick Creek is a major tributary of the East Fork Little Miami River. The project was coordinated and completed by the Clermont County Engineer's Office. During the months of September and October of 1998 a three hundred foot stream-bank section of Stonelick Creek was stabilized using two different bank stabilization techiniques; (1) rock weers; (2) rootwad stabilization. The section of stream that was stabilized was located above the Stonelick Covered Bridge along Stonelick Williams Corner Road in Clermont County.

Clermont County Watershed Management Program

In 1995, Clermont County completed a Wastewater Master Plan that proposed a strategy to effectively treat wastewater throughout the County. As the County developed the plan, it quickly became evident that this alone would not protect the water quality of Clermont's streams and lakes. A number of other potential pollutant sources needed to be addressed if stream quality was to be protected. A comprehensive water resources management approach was needed. Soon after the development of the Wastewater Master Plan, the County initiated a watershed management process to better characterize water quality conditions, implement control measures to protect and improve water quality, and plan for future growth while preserving Clermont's natural character and environment.

In 1996, the Clermont County Office of Environmental Quality initiated a comprehensive monitoring program to characterize stream conditions throughout the East Fork watershed. Since the inception of the program, OEQ has:

- assessed the physical conditions of stream channels,
- conducted annual biological surveys to evaluate the fish and macro-invertebrate communities and their habitat,
- conducted annual water quality sampling to monitor various pollutants,
- established five auto-sampling stations to continuously monitor conditions and collect samples during and after periods of rain.

In 1998, the Office of Environmental Quality began hosting public stakeholder meetings at various locations in the East Fork watershed. Early meetings focused on the basics of stream quality and watershed protection. Information on why water quality is important, both in terms of economics and quality of life, were presented at these meetings. As participants at these meetings began to build an understanding of water quality and watershed management issues, the issues presented became more specific and complex. Eventually, the regular public stakeholder meetings held by OEQ became the basis for establishing the East Fork Watershed Collaborative.

In 2000, Clermont County partnered with the Clermont Soil and Water Conservation District (SWCD), as well as the SWCDs in Brown, Clinton and Highland Counties, to participate in the Ohio Department of Natural Resources Watershed Planning Program. A grant was received to fund a Watershed Coordinator for the East Fork Little Miami River Watershed. The primary responsibility of the coordinator is to guide the development and implementation of watershed action plans for the entire East Fork watershed.

Current Efforts in the Watershed to Meet Water Quality Standards

East Fork Watershed Collaborative

The East Fork Watershed Collaborative (a.k.a. EFWC or the Collaborative) was formed in 2001 to provide local agencies, groups and individuals the opportunity to collaboratively plan and implement water quality improvement projects. The Collaborative's mission is "to enhance the biological, chemical and physical integrity of the East Fork Little Miami River and its tributaries."

The EFWC Steering Committee consists of representatives from four counties and five subwatersheds within the East Fork Little Miami River watershed. The Steering Committee is responsible for defining the scope and direction of the Watershed Program, and acting as liaison between the Collaborative and the local community.

The Collaborative organizes Work Groups to achieve specific tasks as needed. The formation and facilitation of Work Groups was the primary means for soliciting citizen input for the development of the East Fork Headwaters Watershed Plan and East Fork Lake Tributaries Watershed Plan.

The East Fork Watershed Collaborative has accepted the responsibility for developing a watershed management plan for the entire East Fork Little Miami River watershed. Due to the size of the East Fork watershed (500 mi^2 or almost 320,000 acres), and the variability in land use and stream conditions in various parts of the East Fork watershed, the Collaborative made a decision to divide the overall watershed into smaller (i.e., more manageable) subwatersheds for the purpose of planning. The subwatersheds selected as planning units are the Lower East Fork watershed, the Middle East Fork watershed, the Stonelick Creek watershed, the East Fork Lake Tributaries, and the East Fork Headwaters. Subwatershed plans focus on concerns unique to each subwatershed, providing a detailed description of subwatershed characteristics and stream conditions (including causes and sources of impairments), and specific recommendations on how those impairments might be addressed. The Watershed Management Plan for the Lower East Fork was completed, submitted to Ohio EPA and Ohio Department of Natural Resources (ODNR), and endorsed by the State in 2003. The East Fork Headwaters Watershed Management Plan was submitted in May 2006 to Ohio EPA and ODNR and received endorsement in August 2006. The East Fork Lake Tributaries Watershed Management Plan was submitted and endorsed in September 2006. EFWC is currently developing, and expecting to complete and submit to Ohio EPA and ODNR by September 2006, watershed plans for Stonelick and Middle East Fork subwatersheds. Our final watershed management plan for the East Fork Little Miami River will integrate the five subwatershed plans into a coherent whole, highlighting the connections and differences among the subwatersheds.

The watershed planning process has led to an improvement in communication and cooperation among county offices and among the affected counties, municipalities and townships. An example of this cooperation can be seen in the partnership formed among Clermont County's Office of Environmental Quality (OEQ), Water and Sewer District and Health Department to draft and submit a Section 319 grant proposal in April 2003 (see below). Another example can be seen with OEQ and the County's Department of Planning and Economic Development, which worked together to plan and host a Low-Impact Development workshop in 2005. Additionally, years of effort by Clermont County to involve stakeholders in the planning process has resulted in a close relationship with the cities, villages and townships within the County.

Lower East Fork Watershed Management Plan

The Watershed Management Plan for the Lower East Fork was completed, submitted to Ohio EPA, and endorsed by the State in 2003[2]. That endorsement was the culmination of three years work by the Collaborative partners to develop a plan that would meet local water management goals as well as bring the Lower East Fork and its tributaries into use attainment. The Collaborative partners put together a comprehensive inventory of geology, soils, land use, demographics, and biological resources within the Lower East Fork region. Using Ohio EPA data and additional data collected by Clermont County between 1996 and 2002, the LEF Plan described current water resource conditions, and water quality trends. Based on Ohio EPA assessment and local experience, causes and sources of impairment were identified for the East Fork mainstem, as well as for the five major tributaries to the Lower East Fork. The Collaborative partners developed "problem statements" for each assessed stream segment that:

- Described the water resource conditions for that segment with identified causes and sources of impairment;
- Provided loading estimates for the pollutants of concern;
- Presented goals for each pollutant of concern, that, if met, should result in attainment of the assigned use designation;
- Detailed a suite of complementary strategies to mitigate point and non-point pollutant sources, and to restore streams and protect riparian areas; each strategy included specifics on responsible entity, how the strategy will be funded, when it will be implemented, and how performance will be measured.

The Collaborative partners are now implementing the Lower East Fork Watershed Plan. It is worth noting the following activities that will contribute to improved water quality in the Lower East Fork.

- The Clermont Sewer District is in the midst of some $30,000,000 of sewer system improvements that will eliminate SSOs, remove the trunk line from Shayler Run, extend sewers to areas with high concentrations of failing septic systems, and improve the quality of discharge from the Lower East Fork WWTP;
- The Valley View Foundation has partnered with the City of Milford to solicit WRRSP and Clean Ohio

Funds to permanently protect over 100 acres of floodplain and riparian corridor along the Lower East Fork;

- Lower East Fork communities have significantly increased resources devoted to the management of stormwater quantity and quality. Phase II requirements will result in measurable improvements in pre- and post-construction stormwater controls, illicit discharges, and pollution prevention/good housekeeping. The City of Milford recently established a stormwater utility to address historic stormwater management issues as well as the requirements of Phase II, and to offer incentives for BMPs that lessen the impact of stormwater runoff. Clermont County is exploring the merits of a stormwater utility and recently hired a stormwater program coordinator to implement Phase II requirements;
- The Phase II communities in Clermont County are also conducting an aggressive campaign to increase watershed literacy throughout the County and East Fork watershed. Projects include installation of watershed signs, distribution of backyard BMP flyers, storm drain labeling, newsletter and newspaper articles, ...;
- The Collaborative partners are seeking funding to implement portions of the Plan for which there are inadequate local resources; the $335,000 Lower East Fork 319 Grant described below is an example;
- In recent public meetings held in the Hall Run watershed, residents voiced strong support for the proposed project and an interest in being more involved. There appears to be an excellent opportunity to create a "Friends of Hall Run" type group to promote good watershed citizenship, and stream and riparian BMPs. This group could serve as a model for other East Fork subwatersheds and other urbanizing watersheds in Southwest Ohio.

Lower East Fork Section 319 Grant (Restoration of Stream Function and Water Quality Improvement in Tributaries of the Lower East Fork Little Miami River)

The East Fork Watershed Collaborative, in partnership with Clermont SWCD, Clermont County Office of Environmental Quality, Clermont County Health District and Clermont County Sewer District, recently received a $335,000 Section 319 Grant (FY2004) to address water quality impairments in the Lower East Fork watershed. The purpose of the Lower East Fork 319 (*Restoration of Stream Function and Water Quality Improvement in Tributaries of the Lower East Fork Little Miami River*) project is to improve water quality in Hall Run and Wolfpen Run, major tributaries to the Lower East Fork Little Miami River, in an effort to fully attain their WWH status. It is also expected that water quality improvement in these major tributaries will lead to significant improvement to water quality status of the Lower East Fork Little Miami River. The project has the following goals:

- to address habitat alteration and hydromodification in Hall Run, use natural channel design and management techniques to restore and enhance hydrologic and ecological function (in-stream/ riparian habitat) of a stream segment in the Hall Run headwaters;
- to address habitat alteration and hydromodification in the larger East Fork watershed, use the stream and riparian restoration in Hall Run to demonstrate natural channel restoration and management techniques, and other riparian BMPs, that can be applied in headwater streams throughout the East Fork watershed;
- to achieve the maximum amount of environmental benefit for the resources expended, coordinate the stream restoration activities with sewer improvement projects being conducted by the Clermont County Water and Sewer District;
- to reduce the number of failing septic systems (with associated nutrient and pathogen loadings) in the Hall Run and Wolfpen Run subwatersheds, employ an aggressive outreach/educational approach to improve awareness and understanding of septic system operation and maintenance, enroll additional homeowners in the Clermont Health District's Basic System Assessment inspection program, and repair or replace failing septic systems.

East Fork Headwaters Management Plan

The Watershed Management Plan for the East Fork Headwaters was completed, submitted to ODNR/Ohio EPA, and endorsed by the State in August 2006. That endorsement was the culmination of three years work by the Collaborative partners to develop a plan that would meet local water management goals as well as bring the Headwaters and its tributaries into use attainment. The Collaborative partners put together a comprehensive inventory of geology, soils, land use, demographics, and biological resources within the Headwaters region. Using Ohio EPA data and additional data collected by Clermont County between 1996 and 2002, the Headwaters Plan described current water resource conditions, and water quality trends. Based on Ohio EPA assessment and local experience, causes and sources of impairment were identified for the East Fork mainstem, as well as for the 20 major tributaries to the East Fork Headwaters.

The Collaborative partners developed "problem statements" for each assessed stream segment that:

- Described the water resource conditions for that segment with identified causes and sources of impairment;
- Provided loading estimates for the pollutants of concern;
- Presented goals for each pollutant of concern, that, if met, should result in attainment of the assigned use designation;
- Detailed a suite of complementary strategies to mitigate point and non-point pollutant sources, and to restore streams and protect riparian areas; each strategy included specifics on responsible entity, how the strategy will be funded, when it will be implemented, and how performance will be measured.

Highland County East Fork Watershed Water Quality Improvement Project

In 2005 Highland County Soil and Water Conservation District partnered with the East Fork Watershed Collaborative and the Highland County General Health Department to submit an application for an Ohio EPA 319 Nonpoint Source Project Grant. The application was approved and the project began January 2006. The overall purpose of the project is to improve water quality in the Highland County region of the East Fork Little Miami River watershed in an effort to fully attain designated aquatic life use status (EWH, WWH). This is a part of the East Fork Headwaters subwatershed planning area. More specifically, the project will repair or replace failing septic systems, employ an aggressive outreach/educational approach to improve awareness and understanding of septic system design, operation and maintenance, and generally, reduce the number of failing septic systems (with associated reduction of nutrient, solids and pathogen loadings) in Highland County EFLMR watershed. The three main objectives are given below;

1. Reduce nutrient, solids, and bacterial loading, and organic enrichment from failing Home Sewage Treatment Systems (HSTS) in the EFLMR watershed.
2. Use a broad-based education and outreach effort to improve performance of Home Sewage Treatment Systems (HSTS) in the EFLMR watershed.
3. Conduct water quality monitoring to collect impairment data, measure outcomes, and get volunteer citizen participation.

East Fork Lake Tributaries Watershed Management Plan

The Watershed Management Plan for the East Fork Lake Tributaries was completed, submitted to ODNR/Ohio EPA, and endorsed by the State in September 2006. That endorsement was the culmination of three years work by the Collaborative partners to develop a plan that would meet local water management goals as well as bring the Lake Tributaries and its tributaries into use attainment. The Collaborative partners put together a comprehensive inventory of geology, soils, land use, demographics, and biological resources within the Lake Tributaries region. Using Ohio EPA data and additional data collected by Clermont County between 1996 and 2002, the Lake Tributaries Plan described current water resource conditions, and water quality trends. Based on Ohio EPA assessment and local experience, causes and sources of impairment were identified for the East Fork mainstem, as well as for the 22 major tributaries in the Lake Tributaries sub-watershed.

The Collaborative partners developed "problem statements" for each assessed stream segment that:

- Described the water resource conditions for that segment with identified causes and sources of impairment;
- Provided loading estimates for the pollutants of concern;
- Presented goals for each pollutant of concern, that, if met, should result in attainment of the assigned use designation;
- Detailed a suite of complementary strategies to mitigate point and non-point pollutant sources, and to restore streams and protect riparian areas; each strategy included specifics on responsible entity, how the strategy will be funded, when it will be implemented, and how performance will be measured.

Clermont County Office of Environmental Quality

Driven by a commitment to protect the County's existing high quality of life and to support and encourage sustainable growth, the Office of Environmental Quality (OEQ) initiated a comprehensive watershed management program in 1996 to protect the EFLMR. Since that time the County has successfully:

- collected data from a comprehensive monitoring network including biological, chemical, and physical data sets
- developed a linked watershed modeling system of the watershed, lake, and river so that future growth issues can be studied and evaluated
- evaluated management options for control of sources to preserve and enhance tributary and riverine water quality
- developed the Ecological Data Application System (EDAS) database to store and process the water chemistry, biology, and physical stream assessment data
- sponsored the formation of a stakeholder group and conducted public outreach and education efforts, including the development of report cards summarizing water quality and trends
- developed a site assessment tool to evaluate the impacts of new development on water resources
- became a U.S. EPA Project XL Community in September 2000, and completed a Quality Management Plan in August 2001 (subsequently approved by both Ohio EPA and U.S. EPA).

National Demonstration Project for Watershed Management

In September 2003, Clermont County received a $225,000 Section 104(b)(3) grant from the U.S. Environmental Protection Agency to develop an innovative approach to identifying key priorities for improving water quality in the East Fork Little Miami River watershed. This project used a unique and innovative approach that should result in the development of more successful watershed management strategies and improved stream conditions. Under this project, the County, with the help of Tetra Tech, developed a model that provides a statistical relationship linking physical and chemical stressors to biological response (i.e., fish and macro-invertebrate indices). This will provide a more accurate representation of the sources responsible for biological impairment, and thus enable the Collaborative to develop watershed management strategies that will result in marked improvements in stream quality.

While Clermont County and Tetra Tech took the lead on the modeling effort, all counties, municipalities and townships within the watershed will be involved in the strategy and implementation development process. The public stakeholder effort is being led by the East Fork Watershed Collaborative and the East Fork Watershed Coordinator. The first public meeting was attended by over 50 people from throughout the watershed, including representatives from Brown, Clermont, Clinton and Highland Counties.

The Project was completed in June 2006. The East Fork Watershed Collaborative is now exploring the possibilities of establishing different innovative watershed management strategies, including pollutant trading and watershed permitting, to implement the targeted management strategies. If it is decided that such strategies may achieve "superior environmental performance" compared to conventional management practices, Clermont County will work with both Ohio EPA and U.S. EPA to implement these under Project XLC.

Clermont County Sewer System Improvements

Clermont County is implementing many sewer infrastructure improvements in the Lower East Fork watershed. These improvements are detailed in the "Clermont County 5-Year Wastewater Capital Improvement Plan (2003-2007)". Several of the major projects within the Lower East Fork watershed are summarized in the attached Problem Statements from the Lower East Fork Watershed Management Plan. Those improvements include:

- $2,000,000 for extension of sewers into currently unsewered areas. This includes areas with concentrations of failing septic systems in the Hall Run and Wolfpen Run subwatersheds;
- $6,000,000 for update of sewer mains and removal of all SSOs from the Hall Run subwatershed to be completed 2006;
- $20,000,000 for replacement of the trunk line in Shayler Creek to be completed in 2007;
- Renovation of the Lower East Fork WWTP to be completed in 2007.

NPDES Phase II Stormwater Program

A total of 15 communities in Clermont County, including the County itself, were designated as urbanized areas and thus required to submit a Phase II stormwater management plan to Ohio EPA by March 10, 2003. Early in 2002, a group of leaders from affected communities formed a Stormwater Task Force to help the County, municipalities and townships meet the Phase II requirements. This group determined that the most cost effective and efficient approach for addressing the requirements was to develop and implement a regional approach that utilized existing programs to the greatest extent practical. As a result, 13 of the 15 communities jointly developed and submitted a stormwater management plan and applied for a Phase II general permit in March 2003. Only the City of Loveland, which is located in portions of three separate counties, and Tate Township, which applied for an exemption (as only 0.09 square miles are within the urbanized area), did not participate. The amount of cooperation among the different communities illustrates the type of commitment necessary to solve water management problems at a watershed scale.

Since the submittal of the plan, several projects are underway to implement the six minimum controls. There is an extensive public education and notification in place. Many of these activities are being implemented by the East Fork Watershed Collaborative, as well as the Clermont County Soil and Water

Conservation District (SWCD) and the Office of Environmental Quality (OEQ). One particular program of note is the joint stormwater web site developed by OEQ and graduate students from Miami University's Institute of Environmental Sciences. The web site can be viewed at www.oeq.net/sw/. In addition, the students provided a review of county, municipal and township pollution prevention programs already in place and made recommendations to each community for improvement. This project was completed in May 2004.

While the number of projects contained in the County's stormwater management plan are too numerous to discuss in detail, two deserve special notice. These include a regional stormwater best management practice (BMP) manual being developed by Clermont County, Northern Kentucky Sanitation District, and Louisville MSD, and a Low Impact Development workshop hosted by the Clermont County Stormwater Department and the Center for Watershed Protection in February of 2005.

Regional Stormwater BMP Manual

In 2003, the Clermont County Office of Environmental Quality began a joint effort with the Sanitation District No. 1 of Northern Kentucky and the Louisville & Jefferson County (KY) Metropolitan Sewer District to develop a regional manual of post-construction stormwater management practices. By combining resources, the three agencies are able to develop a product they would not have been able to complete alone. This manual will include information for a variety of BMPs with details on their cost, installation procedures, maintenance requirements, and their effectiveness at reducing the levels of different stormwater pollutants. This manual will serve as a valuable resource for local planning departments and members of the development community as they design post-construction stormwater controls for new development. Currently, the manual is in its final draft form and is being reviewed by representatives of three cooperating agencies. A final manual will be available by the end of 2005.

Low Impact Development Workshop

As mentioned in Ohio EPA's 2004 Integrated Water Quality Monitoring and Assessment report, urban runoff is one of the primary sources of stream impairment in the East Fork watershed. Clermont County is seeking to work cooperatively with local planning departments, zoning commissions and members of the development community to address the problem of stormwater runoff. As part of this effort, the Clermont County received an Ohio Environmental Education Fund grant from Ohio EPA in the amount of $11,850 to conduct a low impact development workshop in the early part of 2005. Through this grant, the County contracted with the Center for Watershed Protection to lead the workshop. The agenda for the workshop was developed by an organizational committee comprised of local planners, developers, engineers, and representatives of the Homebuilders Association.

On the day following the workshop, Clermont OEQ hosted a tour of developments that have successfully used designs to minimize stormwater impact. This workshop and tour provided the development community (including planners, developers, engineers, contractors, and zoning and code enforcement officials) with information that will enable them to meet Phase II permit requirements, minimize problems associated with flooding, and become more involved in the watershed management process.

The workshop and tour was held in February 2005, with attendance just over 100. Educational materials, including a workshop CD, were provided as part of the workshop.

Education and Outreach

The East Fork Watershed Collaborative applied for and received two grants to purchase canoes to use for the East Fork river Sweep, Adopt-a-Waterway and other educational programs. The Collaborative received a $11,160 grant from the Boating Safety Education Program of the Ohio Department of Natural Resources, Division of Watercraft, and a $4,980 grant from the Ohio Environmental Education Fund to purchase 16 canoes, two canoe trailers, life vests, and paddles.

With the purchase of the canoes mentioned above, the East Fork Collaborative is looking to expand our Adopt-a-Waterway program. Groups of any size (companies, non-profits, civic organizations) can adopt a stream segment of 2-3 miles length, similar to the Adopt-a-Highway program. The Collaborative provides canoes, trash bags, gloves and trash pick-up for two events each year. There are about 40 "canoeable" miles of the East Fork that could be adopted, and a number of smaller tributaries that would also benefit from an annual clean-up.

On June 14 of 2005, the Clermont County Green Team (Park District, Office of Environmental Quality, Soil and Water Conservation District) teamed with the Harsha Lake U.S. Army Corps of Engineers office and Batavia Township to remove 104 tires from the East Fork River near Elklick Road.

The Collaborative is also hosting educational canoe floats on the East Fork during which local elected officials, other community leaders and landowners learn more about how streams function. During two floats in summer of 2005 attendees heard a historical overview of the area, with a special emphasis on the East Fork River, from Rick Crawford a Clermont County historian. They also discussed opportunities for managing stormwater quantity and quality, and canoed two miles of the East Fork Little Miami River. Stream biologists from the Ohio Department of Natural Resources used an electrical shocking technique to sample the type of fish found in this segment of the East Fork. The biologists shared what they found, highlighting fish species indicative of the good water quality in the East Fork.

As part of a region-wide public awareness campaign called Project SIGNS, watershed signs with tributary names have been posted at about 30 stream crossings in the East Fork Watershed, and about 250 stream crossings throughout the Tri-state area. The Collaborative received a $1000 Watershed Awareness to Watershed Action (WAWA) grant from the ODNR to purchase and install watershed signs at stream crossings in the upper portion of the East Fork watershed.

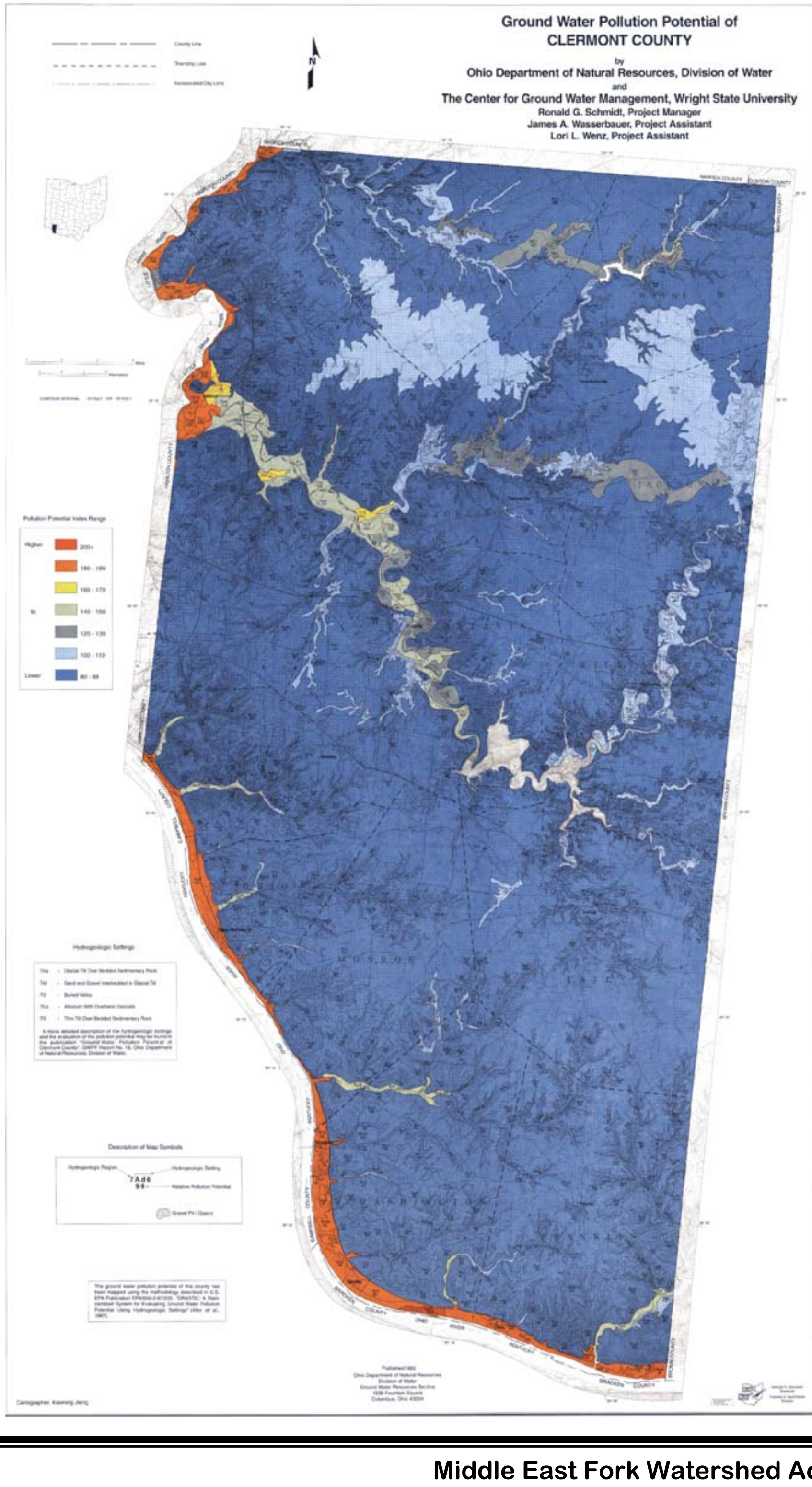
East Fork Website

The East Fork Little Miami River Watershed website is a useful tool for informing and involving the local communities. Information on local projects, programs and events is included, and the Watershed Action Plans are available to be viewed and downloaded. There are maps and general descriptions of the East Fork, as well as links to other educational resources pertaining to water resource protection.

To bolster the website as a tool for communication and action, the Collaborative plans to make updates that will allow visitors to sign up as Collaborative Extension members. Visitors who sign-up as members will receive the East Fork Newsletter, email announcements of upcoming event and information on volunteer opportunities. The aim is to capture the contact information of interested individuals, provide opportunities for watershed action, and ultimately, build a database of local contacts to establish a community network within the watershed. Additional upgrades and visual enhancements will also be added to the website as resources become available.

APPENDIX B
Ground Water Pollution Potential Map for Clermont County

Source: http://www.dnr.state.oh.us/water/gwppmaps/



APPENDIX C
Chemical Use Analysis and Tillage Practices of the Entire East Fork Little Miami River Watershed

This Appendix presents the chemical use analysis data of agriculture, horticulture, and highway/infrastructure chemical use throughout the entire East Fork Little Miami River watershed obtained during the 1997 Land Use and Chemical Analysis study conducted by Clermont SWCD and OSU Extension completed in May 1999.

Agricultural Chemical Use Analysis

Preserving and improving the quality of the water resources of the EFLMR watershed are two key goals. With the increasing demands upon Lake Harsha to be a reliable source of clean, safe drinking water, it is imperative that a proactive approach be taken to ensure that this valuable resource be maintained. With 50 percent of the watershed being in some form of agricultural utilization, efforts are certainly needed to address concerns that are associated with this industry.

Corn acreage within the watershed was 47,685 in 1997. Based on the information collected, 90 percent to 95 percent of this acreage received some form of atrazine herbicide. Most farmers are using the chemicals at the rate of two pounds of active ingredient per acre. This would indicate that between 43,000 and 45,500 acres will have atrazine applied for weed control. This would translate to atrazine applications between 86,000 and 91,000 pounds. Harness was another herbicide that was used on the remaining 2,300 to 4,500 acres. Harness and atrazine are restricted pesticides and have a ground water advisory statement.

Table I provides an inventory of chemicals associated with corn production and the estimated total amount of each herbicide applied in the watershed during 1997.

Table I Estimated Chemical Use in Watershed - Corn Production

Chemical Name	% Use Watershed	Total Acres	Total Amount
Etrazine 4L (Bladex & Atrazine)	46%	1,897	2,371 qts.
Bicep II (Dual II & Atrazine)	36%	1,477	2,954 qts.
Harness	12%	519	519 qts.
Lariat (Lasso & Atrazine)	4%	159	636 qts.
2,4-D	2%	71	35 qts.
Total	100%	4,123	N/A

Herbicides

Atrazine is the corn herbicide that has received considerable attention regarding water quality. Restrictions regarding the use of this chemical have increased in recent years. Farmers are more aware of the concerns surrounding the use of this herbicide. Restrictions are in place that limits application within 200 feet of a lake or reservoir. A 66 foot buffer strip has been established for application near a stream. If the land is highly erodible, the 66 foot buffer zone must be planted in a cover crop. For mixing and loading, a 50 foot set back is required to protect wells and streams.

With the financial pressure and small profit margins (or no profit) that has existed for the past three years, the use of atrazine is likely to continue. Atrazine currently provides the best weed control for the dollar spent. As the Roundup Ready corn becomes more available and affordable, this technology should become more acceptable. Farmers are aware of the concerns surrounding atrazine and do not want more restrictions or the complete loss of this valuable herbicide. Chemicals are expensive and farmers can not afford to waste money.

Other herbicides applied within the watershed are Dual II, Bladex, 2,4-D, Lasso, Harness and Roundup. These chemicals are typical applied with atrazine or in a pre-mix combination.

Nearly double that of the corn acreage, soybeans were the major crop grown in the watershed during 1997. The 88,823 acres represents 56 percent of the total production agricultural land. The herbicide of choice is Roundup. With the advantages that exist with Roundup from an economic stand point, weed control results and reduced labor costs, the use of this technology will continue to increase. In 1999, there could be a 65 percent to 75 percent use of Roundup Ready soybean across the watershed. In those areas where the utilization of this technology has lagged behind, the trend is that more farmers are adopting this method. The areas of the watershed that produce the majority of the soybean are presently utilizing this technology on 75 percent of the acreage. With the advantages associated with the use of Roundup from both the farmers' viewpoint and a water quality standpoint, this certainly presents an encouraging picture for the future.

Due to the combination of herbicides such as Tricept, Squadron, Turbo and Canopy the total amount of each specific chemical is more difficult to determine. For example, Sencor was applied to 19 acres not 111 because of the pre-mix Turbo. Sceptor was applied to a total of 1,819 acres not 481 acres due to the application of Squadron and Tricept. The survey did not indicate a large number of acres with Roundup even though there is an extensive amount of Roundup Ready soybean being grown in the watershed.

Table II lists the estimated chemical use in the watershed for the production of soybeans.

Table II Estimated Chemical Use in Watershed for Soybean Production

Chemical Name	Total Acres	Total Amount
Canopy (Classic & Lexone)	1,346	210 qts.
Turbo (Sencor & Dual II)	1,048	1,376 qts.
Dual II	334	443 qts.
Sencor	111	42 qts.
Squadron (Sceptor & Prowl)	329	494 qts.
Tricept (Sceptor & Treflan)	1,009	1,160 qts.
Sceptor	481	32 qts.
Assure II	542	13 qts.
Roundup	247	247 qts.
Lasso	104	234 qts.
Pursuit	203	25 qts.

Fertilizers

Fertilizers are also a concern when considering water quality. Based on the Ohio Agricultural Statistics and Ohio Department of Agriculture Annual Report an expected yield of 140 bushels is reasonable for the watershed. The Tri-State Fertilizer Recommendations for corn for this desired yield would be 160 pounds of nitrogen per acre. Data collected would indicate that farmers (83 percent) are using 200 plus pounds per acre. Based on the corn acreage of 47,780, nitrogen application is between 7,644,800 and 10,511,600 pounds of actual nitrogen in the watershed. Corn is very dependent upon nitrogen for high yields. It would appear that farmers are applying too much nitrogen. Applying 220 pounds of nitrogen per acre should produce 180 plus bushels per acre. This would appear to be a waste of money for the farmers and may be exposing the water resources to nearly 3,000,000 pounds of nitrogen that is not required. An educational effort is necessary to inform farmers regarding this matter.

Phosphorus is the second major nutrient of concern. The recommendations for phosphorus are harder to state in an across the board application due to varying levels of soil fertility, pH and the cation exchange capacity of the soil. To produce one bushel of corn, phosphorus is required at the 0.37 pounds per acre (P_2O_5) rate. This is strictly a maintenance level of production. To produce 140 bushels of corn per acre a farmer would need to apply 52 pounds of actual phosphorus per acre. If average fertility levels (30 to 60 pounds/acre) exist in the field then this application rate would be adequate. Application rates can exceed 100 pounds per acre if soil fertility levels are low. If soil fertility is below average (20 pounds available/acre), to produce a 140 bushel yield would require an additional 75 pounds of actual phosphorus.

Based on the data collected from the farmers' survey and the vendors' responses, farmers would appear to be applying excessive phosphorus. This data would indicate that 70 percent of farmers are applying phosphorus at the rate of 90 pounds or more per acre. Application of 100 pounds or more are being applied by 63 percent of the farmers surveyed. If application rates were reduced by 40 pounds/acre across the watershed there would be a reduction of 1,911,200 pounds of actual phosphorus applied.

The third nutrient of concern is potassium. Corn harvested as grain removes 0.27 pounds of K_2O/acre. However, to make a potassium application recommendation that would be applicable to all farms is more difficult than phosphorus. The reason being the numerous combinations of soil fertility level, cation exchange capacity, and desired yield. An average soil test would have a soil fertility level of 200 to 260 pounds/acre, a CEC of 10 and desired yield of 140 bushels /acre. An application of 60 pounds/acre of actual potassium would be required. Data collected would indicate that farmers are applying too much potassium. Vendors stated that farmers are applying between 100 to 140 pounds/acre. The surveys indicated that farmers are applying potassium at the rate of 120 to 149 pounds/acre (27 percent) and 150+ pounds/acre (68 percent). It would appear that double the recommended amount of potassium is being applied. A reduction of 60 pounds/acre would result in 2,866,800 pounds of potassium not being applied.

As stated previously, some farmers could be applying higher rates of phosphorus and potassium to their corn crop to provide nutrients for the next year's soybean crop. Not all farmers utilize this farming practice. A corn/soybean rotation is not practiced by all farmers. Excessive nitrogen is being applied and it is very likely that phosphorus and potassium are being applied at rates that are higher than recommended.

Farmers in the watershed are producing 88,729 acres of soybean. Approximately 75 percent of this acreage receives zero nitrogen. The remaining acres have less then 30 pounds/acre of nitrogen applied. The impact on water quality is not a concern.

Phosphorus is removed at the rate of 0.80 pounds/bushel produced. A typical field would need 30 to 40 of P_2O_5 pounds/acre to produce a yield range of 40 to 50 bushel/acre. The vendors indicated that farmers are purchasing between 50 to 90 pounds of phosphorus per acre. Farmers indicated that they are utilizing 60 to 100 pounds/acre (64 percent), 30 to 59 pounds/acre (20 percent) and 0 to 29 pounds/acre (16 percent). Based on this information, farmers are applying phosphorus at rates that are excessive. If 70 percent of farmers would reduce their application rate by 40 pounds/acre there would be a reduction of 2,484,412 pounds across the watershed.

Soybeans remove potassium at the rate of 1.40 pounds/bushel harvested. A yield of 40 to 50 bushels/acre would consume 56 to 70 pounds/acre. Tri-State Fertilizer Recommendation for a field with average fertility characteristics of 200 to 260 available K and a CEC of 10, producing a 40 to 50 bushels/acre yield would be 75 to 90 pounds/acre. The vendors indicated that farmers are applying potassium at the rate of 75 to 110 pounds/acre. The survey indicated that 29 percent of the farmers are applying K at the recommended rate. Application rates of 150 to 180 pounds/acre were being utilized by 47 percent of the farmers surveyed. An additional 8 percent were applying K at the rate of 120 to 149 pounds/acre. This would suggest that 55 percent of the farmers are applying excessive K. If application rates would be reduced by 50 pounds/acre in the highest application range, a 2,085,131 pound reduction would result. Additional reduction would occur if the additional 8 percent would bring their application rates more in line with recommendation levels.

Wheat production is limited in the watershed. Few chemicals are utilized in the production of the wheat crop. Fertilizer usage falls in the recommended range. The impact upon water quality would be very limited.

Tobacco acreage is extremely small in the watershed. The use of fertilizers can be heavy, especially nitrogen. Chemical usage for insect and disease control is more prevalent than for other crops. Due to the small acreage the overall impact to water resources is limited.

Forage production is not utilizing fertilizers and chemicals to any great extent. The impact on the watershed is very limited.

Horticultural Chemical Use Analysis

This section addresses the status of chemical application by homeowners and horticultural businesses in comparison to the official recommendations of Ohio State University Extension. This section is divided by the types of horticultural operations including home lawn care, grounds maintenance, golf course, nursery/greenhouse, fruits, and vegetables.

Home Lawn Care

Home lawn care involves many horticultural practices such as proper grass selection, seeding, mowing, water, core aeration in addition to lawn fertilization, weed control, and pest management. Typically a recommended fertilization program is a four step program. Fertilizers should be applied once in May, once in July, once in September, and once more in November. However, if someone only fertilizes their lawn once, late fall fertilization should be the best option. If two lawn fertilizations are made, fertilization once in late fall, and once in spring would work well. Fertilizer ratios of 3-1-2 to 5-1-2 are preferred. The recommended rate is about 0.5 to 1.5 pounds actual nitrogen per 1,000 sq. ft. One recommended fertilizer for home lawn is the one with N-P-K ration of 24-4-12 at 2 to 4 pounds per 1,000 sq. ft.

The fertility programs used by national lawn care companies are typically 4 to 5 steps, similar to what Ohio State University Extension recommends for a high maintenance program. The fertility programs by local lawn care companies varied greatly based on the knowledge of business owners. There is a great deal of fertilizer application misuse by both homeowners and some lawn care companies. One good example is the application of fertilizers 10-10-10 or 19-19-19 for grasses instead of recommended N-P-K ratios of 3-1-2 to 5-1-2. This practice resulted in the over application of phosphorus and potassium, and under appliation of nitrogen. Some of the commercial blends like Scotts' or TrueGreen ChemLawn lawn fertilizers have too much nitrogen, and too little phosphorus and potassium.

Weed control programs in home lawns are pretty standard. Many homeowners applied pre-emergent herbicides for the control of crabgrasses in late winter to early spring as recommended by manufactures. For broadleaf weeds, many homeowners or commercial companies applied 2,4-D, Dicamba, and MCPP as recommended. However, these products were put down too early resulting in the application of additional herbicides later in the season. Best timing for dandelion control is when it reaches puffball stage. That developmental stage is typically May.

For insect control such as white grubs, misuse of insecticides is much more widespread. Many garden centers start selling grub control chemicals in spring. That leads to the application of many insecticides at the wrong time. The correct timing for most grub control materials is in late July and early August. One chemical that should be applied earlier is GrubEx. The proper timing for GrubEx is mid May.

Grounds Maintenance

Many grounds maintenance companies are involved in mulching, fertilization, weed control, and pesticide. There is a very large variation among these companies in terms of the levels of expertise. There are many hundreds of ornamental plant species with 10 to 15 common insect and disease problems. Misdiagnosis does occur and leads to misapplications of pesticides. The companies we received survey responses from did not seem to fall in that category since they make use of Extension offices, attend pesticide applicator training, and tend to follow recommendations by Ohio State University Extension.

Golf Courses

Golf course superintendents go through intensive training each year since golfers and greens committees demand perfection. Several pesticides and fertilizers are applied on the golf courses. Most of golf courses follow the recommendations by Ohio State University Extension very closely. Based on the survey received from one golf course superintendent in Brown County, it appears that very little misuse exists.

Nursery/Greenhouses

There are several small nurseries and greenhouses located in the watershed. Many bulletins have been developed for specific crops in the floriculture industry by Ohio Florists' Association in close cooperation with Extension specialists at Ohio State University. Most nursery and greenhouse growers tend to spray less than what are recommended in OSU Extension bulletins. For example, there are bulletins on geraniums, garden mums, bedding plants, and hanging baskets. With nurseries, growers can grow an assortment of trees, shrubs, perennials, ground covers, and ornamental grasses. No two growers have identical crop makeup in either nurseries or greenhouses, especially with smaller operations. Many growers will purchase plants from other growers (to resale), in addition to the plants they grow themselves. Generally chemical application by our greenhouse and nursery growers is very low, mainly due to higher tolerance to insects, diseases, and weeds compared to that of flower growers in Western parts of Cincinnati or nursery growers in Lake County, the nursery capital of the mid-west.

Fruits

The recommended spray programs are listed in the OSU Extension bulletins "Commercial Tree Fruit Spray Guide" and "Commercial Small Fruit and Grape Spray Guide." A typical spray program for apple trees is listed in Table III.

Table III Spray Program for Apple Trees

Developmental Stages	Insecticides	Fungicides
Dormant to silver tip	None	Bordeaux mix plus oil and Ridomil 2E if needed
Green Tip	Apollo SC at 4-8 fl. oz for mite control	Benlate 50 WP at 8-12 oz./acre or fungicides
Half-inch green	Thiodan 3 EC at 2.67 - 4 qt./acre or other insecticides	None
Tight cluster	Savey 50 WP at 4-8 fl./acre or other miticides	Mancozeb 80 WP at 3 lbs./acre or other fungicides
Pink	Carzol 92% SP at 2 lbs. Per acre or other insecticides.	Bayleton 50 DF at 2-8 oz plus Captan at 6 lbs. per acre or other fungicides
Bloom	None to save honeybees!	Fungicides plus Streptomycin 17 W
Petal Fall	Guthion 50 WP at 2-3 lbs. Per acre and Lannate 90 SP at 1 lb. per acre	Nova 40 WP at 5-8 oz. per acre
First and second cover	Ziram 76 DF at 6-8 lbs. per acre or other insecticides	Mancozeb 80 WP at 3 lbs. per acre or other fungicides
Third cover	Sevin EXL at 3-4 qt. per acre or other insecticides	Captan 50 WP at 6 lbs. per acre or other fungicides
Summer cover sprays	Imidan 70 WP at 2.13 - 5.3 lbs. per acre or other insecticides	Captan 50 WP at 6 lbs. per acre or other fungicides

Spray programs are developed from many years of field research. In the watershed, fruit growers with significant acreage follow the spray programs very closely. The common fruits grown in the watershed are apples, pears, peaches, blackberries, blueberries, and raspberries. Growers with few fruit trees and bushes sprayed very little since they do not depend on the fruit production as a significant source of their income.

In general, successful fruit growers make use of both soil testing and tissue testing for their fertilizer recommendations. The desirable soil test maintenance levels are listed in Table IV.

Table IV Desirable Soil Test Maintenance Levels

Nitrogen	Phosphorus	Potassium
40 to 150 lbs. of N per acre	30 - 90 lbs. of available P per acre	200 - 400 lbs. of exchange-able K per acre

A fruit grower in Clermont County did not apply fertilizers in his orchard in 1997 while another grower in Highland County (outside the watershed) applied 250 pounds. of nitrogen, 125 pounds of phosphorus, and 125 pounds of potassium. One grower experienced severe under fertilization while the other experienced over application of nitrogen and phosphorus.

Vegetables

Common vegetables grown in the watershed are tomatoes, peppers, pumpkins, green beans, and sweet corns. Chemicals labeled for each crop are different. The fertility program for tomatoes is listed in Table V.

Table V Fertility Program for Tomatoes

Nitrogen	Phosphorus (P_2O_5)	Potassium (K_2O)
Broadcast 60-80 lb N/A prior to planting. Sidedress with an additional 30-60 lb N/A with calcium nitrate.	100-175 lbs.	200-350 lbs.

Vegetables are definitely not pest free. There are many pesticides that need to be applied on vegetable crops if high quality crops are expected. Vegetable growers seem to have applied much fewer chemicals than the OSU Vegetable Production Guide called for. This is likely due to a combination of economics and good pesticide management practices. Most vegetable growers sell their crops at local farmers' markets where consumers are willing to accept some imperfections on the produce.

Generally the pesticides applied by horticultural businesses in the watershed were minimal. Fertilizers represent the largest percentage of chemical input in both commercial horticulture and residential areas. In the future, we might see more small farms specializing in horticultural crops especially flowers, vegetables, trees and shrubs, and sod. We might see more housing developments, and possibly more golf courses. Education of small scale farmers, developers, and homeowners will be critical to maintain and improve the water quality in the watershed.

Highway and Infrastructural Chemical Use Analysis

Based upon the estimated 310 miles of major highway within the EFLMR total watershed, application of 2,973 tons of salt and 822 gallons of 2.5 percent active ingredient Roundup Pro are estimated to have been applied.

Conservation Tillage

Sediment is another source of water pollution. Conservation tillage is the number one defense against sediment. Reducing soil loss also decreases the potential pollution problems associated with fertilizers and pesticides. Conservation tillage is designed to leave residue on the soil surface. The residue protects the soil surface from erosion by absorbing the energy of raindrops, thus reducing soil particle detachment. Residue reduces surface crusting and sealing which improve water infiltration. A third benefit of residue is the slowing of the velocity of the runoff water. This can allow particles in the runoff to be redeposited.

Conservation tillage leaves residue that is important in reducing runoff. Due to the protection that residue can provide, it was important to determine the type of tillage practices that farmers were using. Farmers were asked to state the type of tillage system that they had selected for each field that they were farming. The three tillage practices that farmers were ask to choose from were conventional, minimum, and no-till. The data collected are shown in Table VI.

Table VI Tillage Practice by Crop in Acres and Percent

Tillage Practice	Corn	Soybean	Wheat
No-till	878 (21.2%)	704 (15.2%)	120 (60%)
Minimum	338 (8.2%)	1,969 (42.6%)	82 (40%)
Conventional	2,925 (70.6%)	1,946 (42.1%)	0
Total	4,141	4,619	200

Corn producing farmers are still using conventional tillage (71 percent) in the majority of their operations. The heavy, wet soils that make up a large portion of the watershed create difficulties for farmers when using either a no-till or minimum tillage practice. Compaction is another concern when working wet soils in early spring. Soybean producing farmers have adopted conservation tillage practices more extensively. Roundup Ready soybean have aided in the transition to either no-till or minimum tillage practices. The later planting dates can allow the soil to dry out more. The wheat crop for which information was available indicates extensive use of conservation tillage practices.

APPENDIX D

Analysis of Physical Stream Characteristics in the Middle East Fork , Clermont County

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November 9, 2001

Over the past six years, Clermont County has developed and maintained a comprehensive watershed monitoring program for the East Fork of the Little Miami River (EFLMR). Integrating both ambient and wet weather water quality data with biological monitoring, this program has provided a comprehensive system for determining the baseline water quality and ecological health of the EFLMR. One additional component of watershed health previously not evaluated is the physical, or geomorphic, condition of the streams draining to the EFLMR. Information on stream physical conditions can be very useful for obtaining a better understanding of overall watershed health, identifying areas of altered or degraded physical habitat, and developing the data necessary to understand how land use change might affect the physical characteristics of county streams.

This Appendix details a preliminary evaluation of stream channel conditions within two Middle East Fork streams located in Clermont County using the Rosgen Level I and II stream classification system. In this section, a description of each assessment reach is provided. Also included is a description of upstream land use and riparian area characteristics at the sample reach. A picture is also included, although technical difficulties resulted in some sites not being photographed. Finally, any available water quality or biological data are presented.

Rosgen Stream Classification

The Rosgen stream classification system is a methodology used to describe streams and stream behavior based on basic hydrologic and morphological parameters (Rosgen, 1996). It uses a hierarchy of four assessment levels ranging from a broad geomorphic characterization (Level I) to detailed reach-specific hydraulic and sediment relationships (Level IV).

A Level I assessment classifies streams based on broad geomorphic stream characteristics. This characterization provides a framework for initial delineation of stream types and assists in setting priorities for more detailed assessments. A Level II (morphological) characterization provides a more detailed description based on field determined stream reach information. Level II information can be used as a basis for management interpretations. The third (Level III or "state") characterization level utilizes additional field observations and parameters to provide a description of stream conditions in terms of current and potential natural stability, and provides an assessment of the extent of departure from the natural potential. The fourth (Level IV or validation) assessment level is used to verify the assessment of stream condition, potential, and stability obtained in the Level III assessment. The Rosgen stream classification system has been found to provide a consistent methodology for comparing physical stream characteristics and stream behavior. In this study, only Level I and Level II evaluations were performed.

Rosgen stream classifications are performed to:

- •Obtain physical stream data using a consistent methodology
- •Classify and compare streams based on observed data
- •Identify impacted stream channels
- •Correlate physical stream characteristics to water quality and biological data
- •Quantify stream stability and erosion rates
- •Describe stream behavior

The data obtained from the different assessment levels can be used to:

- •Predict stream response to major storm events
- •Predict stream erosion rates and sediment loads
- •Predict stream response to road and bridge construction
- •Predict stream response to urbanization practices (e.g., housing developments, construction sites)
- •Provide guidance in performing stream restorations

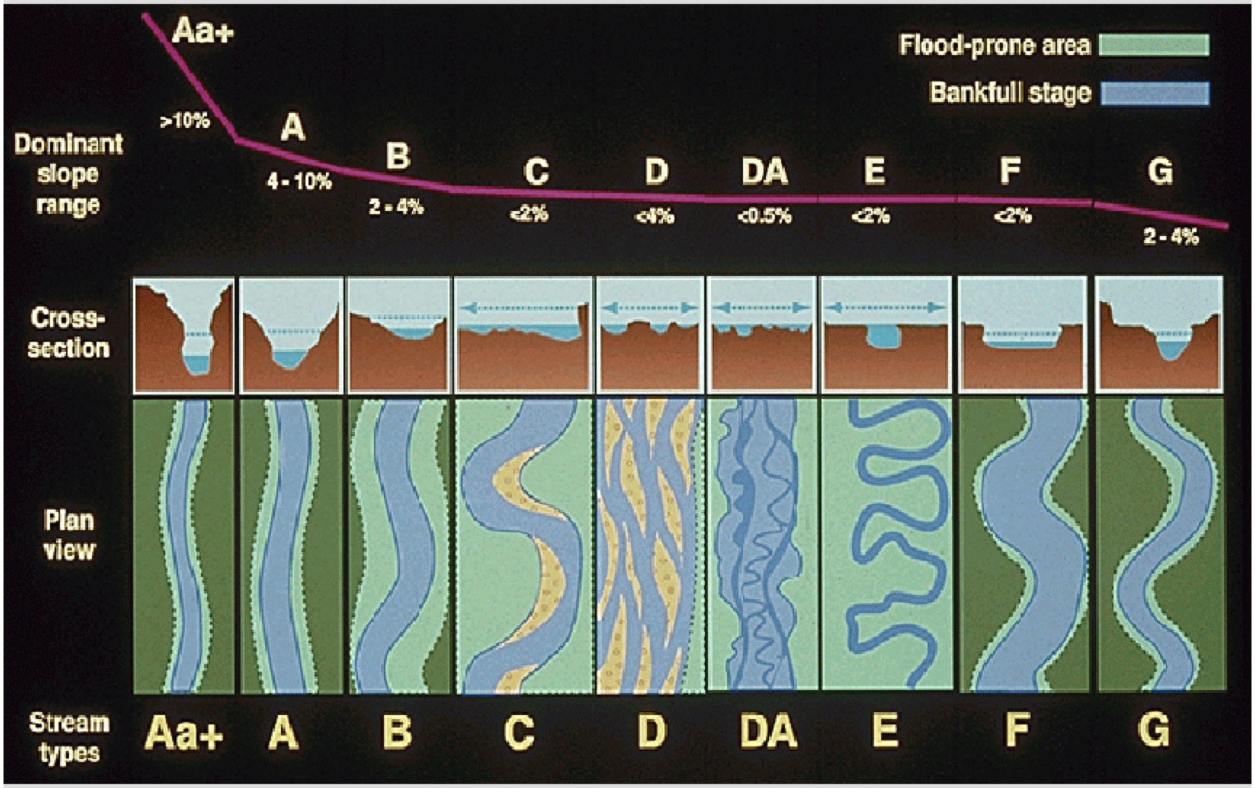


Figure D-1. Rosgen Level 1 Stream Types (Rosgen, 1996).

Rosgen Type	Slope Range	Sinuos-ity Range	Observed in Clermont County?	Notes
A	4-10%	1.0-1.1	Yes	Steep, entrenched, cascading step-pool systems. High energy and debris transport in depositional soils, stable in bedrock and boulder channels. Typically stable.
Aa+	>10%	1.0-1.2	No	Very steep. Entrenched, cascading step-pool systems. Vertical steps with deep scour pools. This type includes waterfalls. Typically stable.
B	2 - 4%	>1.2	Yes	Moderately entrenched, step-pool systems, on moderate slops. Typically stable.
C	<2%	>1.4	Yes	Slightly entrenched, sinuous channels connected to floodplains. Riffle-pool morphology with point bar formation on inside bends. Typically stable.
D	<4%	N/A	No	Found in broad valleys, slightly entrenched, unstable multi-thread channel. High bedload. Typically very unstable.
DA	<0.5%	Highly Variable	No	Broad, low-gradient multi-thread channels typically draining extensive wetland complexes. Typically stable.
E	<2%	>1.5	Yes	Very sinuous, stable channels typically found in broad open fields. Riffle pool morphology. Narrow and deep (low width-depth ratio).
F	<2%	>1.4	Yes	Entrenched channel with high bank erosion rates. Low gradient with a riffle-pool or run-pool morphology. Typically unstable.
G	2 - 4%	>1.2	Yes	Gullies, typically with step-pool morphology. Moderate slopes. High bed load. Typically unstable.

Figure D-2. Rosgen Level 1 Stream Type Descriptions and Occurrence in Clermont.

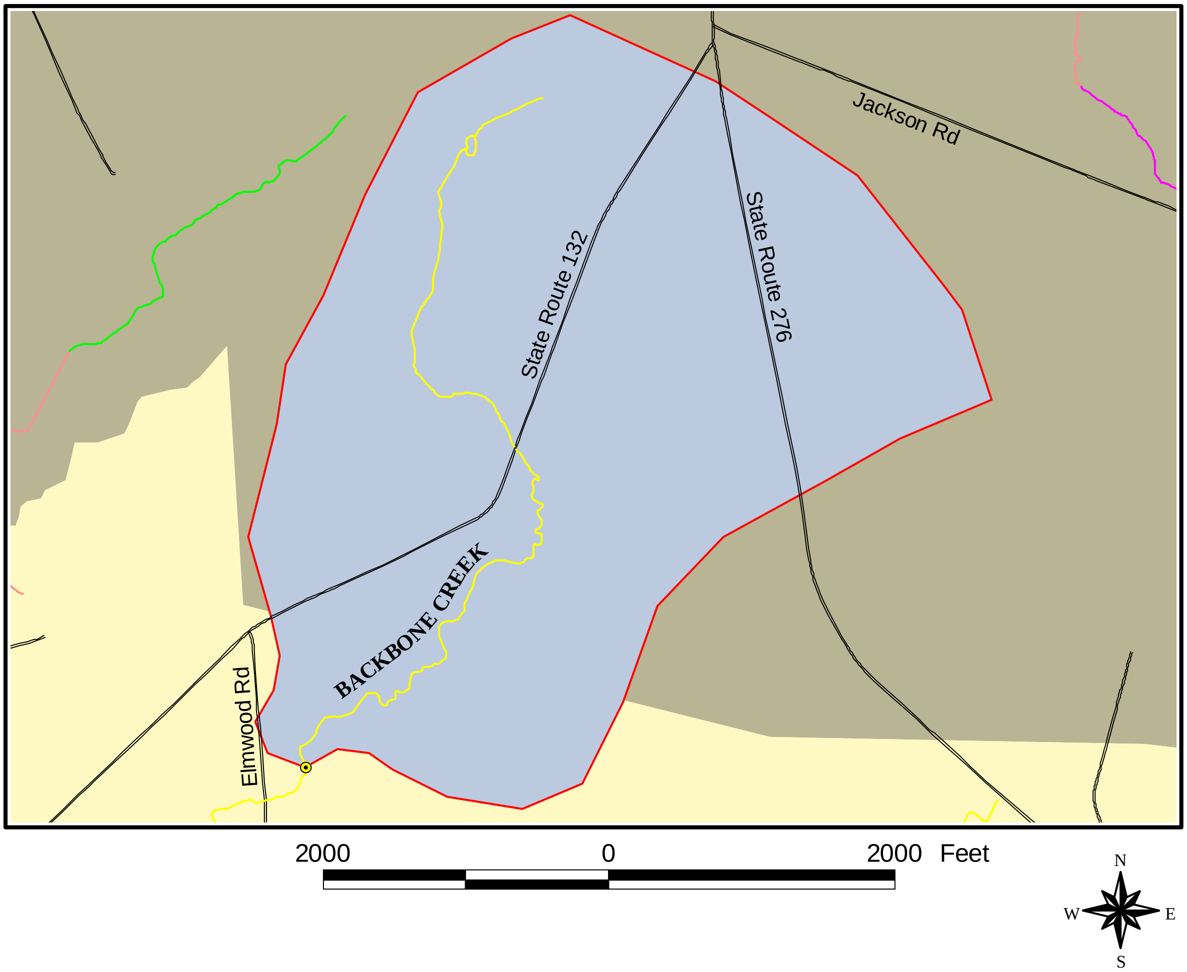
Backbone Creek

The Backbone Creek watershed is located east of Batavia Village and south of Owensville Village in Batavia and Stonelick townships (Figure D-4). The stream flows from east to west to the confluence with the EFLMR near Batavia Village. The Rosgen Level II sampling site was located in a wooded lot off Elmwood Drive in Batavia Township (Figure D-3). At this site the watershed size was 0.64 square miles with 3.9 miles of upstream streams. Land use in the watershed consisted of mostly forest (55 percent) and agricultural land (38 percent). Although the watershed is mostly undeveloped, parts are zoned for estate residential, suburban residence, urban residence, and industrial land use.

Basin Geomorphic Condition

Streams in the Backbone Creek watershed were identified as F streams by the Rosgen Level I analysis. F streams have highly entrenched channels and high erosion rates. At this site, a riffle-pool stream morphology was observed. However, at the time of sampling there was little water flowing through the stream. The sampling site was classified as an F4 stream. The stream appeared to be entrenched and had a water surface slope of less than 2 percent. The stream bottom primarily consisted of gravel, although cobbles were found throughout the stream. Chemistry and biology data were not collected in the Backbone Creek watershed.

Figure D-3. Backbone Creek Sampling Site.



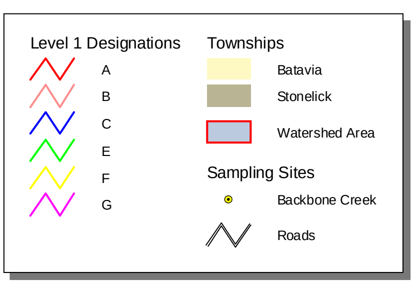
WATERSHED INFORMATION

Watershed Size: 0.6 sq. miles

Stream Miles: 3.9 miles

Major Land Use: Forest

Rosgen Level 2 Designation: F4



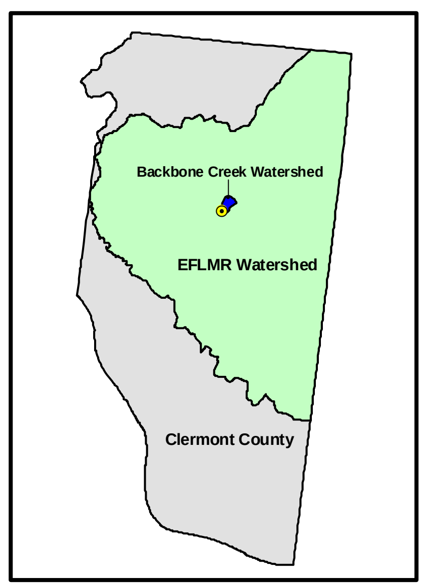


Figure D-4. Location Map of Backbone Creek.

Lucy Run

Located in the central portion of the EFLMR watershed, the Lucy Run watershed contains mostly forest and agricultural land uses (42 percent and 38 percent, respectively). It is located northeast of Amelia Village in a rapidly developing area of Clermont County (Figure D-6). More than half of the watershed is zoned for residential or business development. Also, agricultural land in this area is being converted into large residential lots. The Rosgen sampling site was located in a forested area near Apple Road (Figure D-5). At the site, the watershed size was 1.77 square miles and there were 10.2 square miles of streams upstream of the site. There were large riparian areas near the sampling site that became smaller in the upstream agricultural areas.

Basin Geomorphic Condition

Streams in the Lucy Run watershed were classified as B streams. The B stream is a moderately entrenched step-pool system with low sinuosity. B streams are generally very stable and have stable banks and channels. At the sample point, a B4c stream was observed. The B4c type is a step-pool system with a slope of less than 2 percent, moderate entrenchment, and a small floodplain adjacent to the active channel. The dominant channel particle size was determined to be gravel. Limestone bedrock was also frequently observed in this reach.

Ecological and Water Quality Conditions

As described by Grimm and Guttman (2000), the health of the aquatic community was evaluated at Lucy Run in 2000 at a location near the confluence with the EFLMR. The fish community was rated excellent and had a large number of pollution sensitive species. Invertebrate and habitat conditions were rated "good" by Christian and Guttman (2000). Clermont County also collects water quality data at this location. Suspended solids, total volatile suspended solids, and turbidity data collected at the Lucy Run site in 2000 were lower than most stations in the EFLMR watershed and generally indicated good water quality with respect to sediment (Tetra Tech, 2001a). There was no apparent 5-year trend found with the suspended solids data (Tetra Tech 2001b). These data coincide with the fact that the Lucy Run watershed is comprised mostly of stable, B-type streams with large riparian areas.

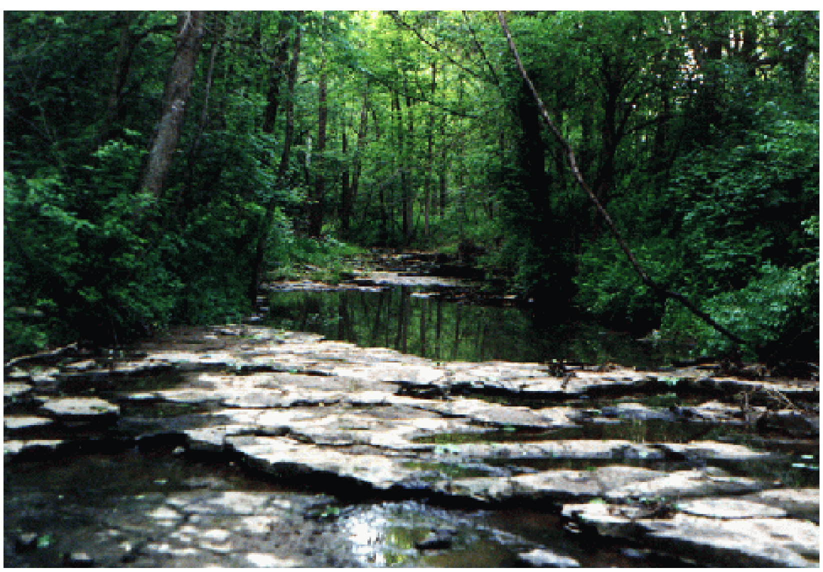


Figure D-5. Lucy Run Sampling Site.

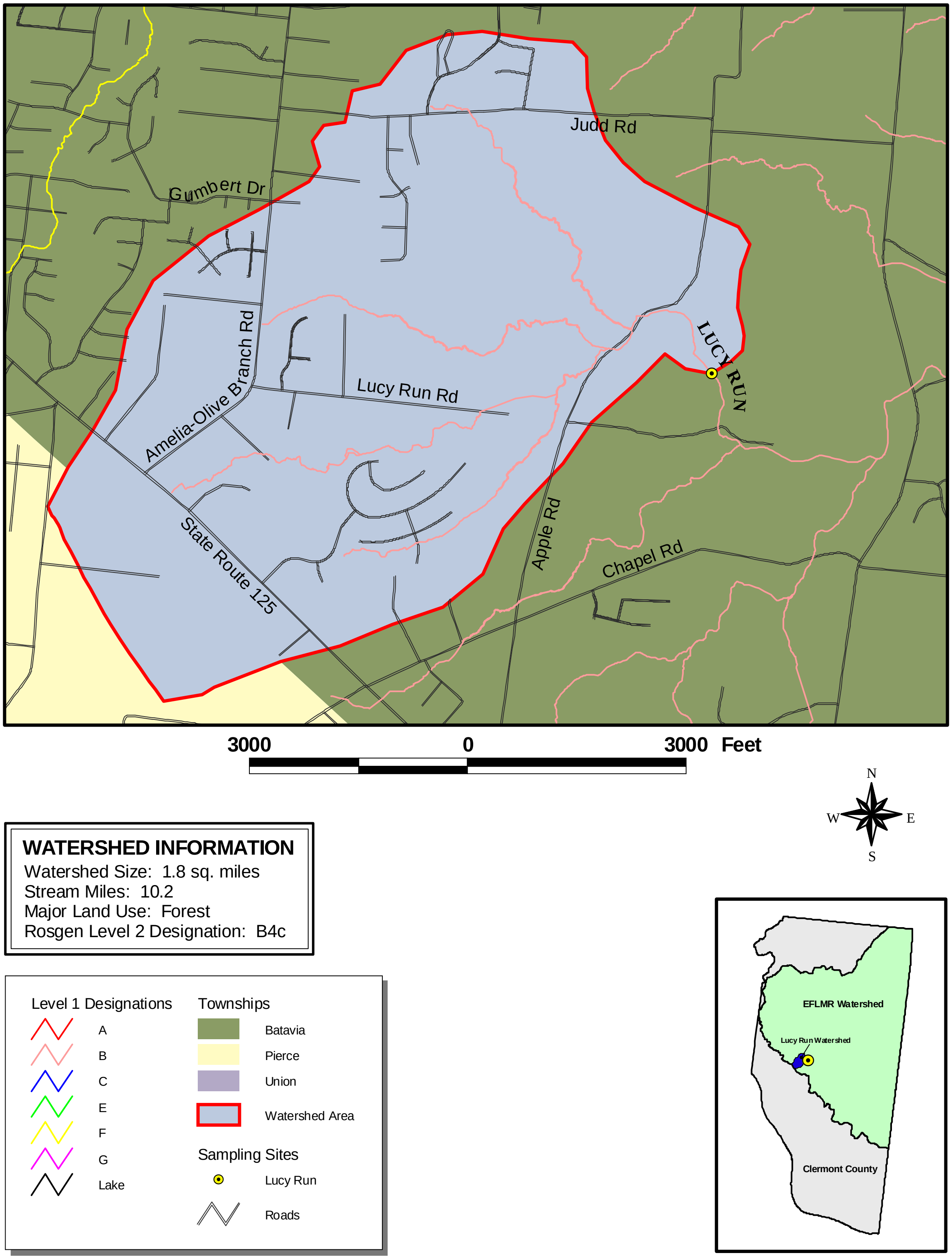


Figure D-6. Location Map of Lucy Run.

APPENDIX E

A National Demonstration Project for Watershed Management: An Innovative Approach to Identifying Key Priorities for Improving Water Quality in the East Fork Little Miami River Watershed

Prepared by the East Fork Watershed Collaborative
April 18, 2007

EXECUTIVE SUMMARY

The East Fork Little Miami River (EFLMR) watershed covers approximately 500 square miles in southwestern Ohio, from its headwaters in rural Clinton, Highland, and Brown counties to its confluence with the Little Miami River in suburban western Clermont County. In 1975, the U.S. Army Corps of Engineers impounded the East Fork by constructing an earthen dam at River Mile 20.5, creating a 2,160 acre reservoir (Harsha Lake) stretching approximately ten miles upstream from the dam. Based on surveys conducted in 1982 and 1998, the Ohio Environmental Protection Agency (Ohio EPA) has determined that various waterbodies in the EFLMR watershed are not meeting their use attainment goals. As a result, the EFLMR was placed on the state's impaired waters list in 2006 and designated for Total Maximum Daily Load (TMDL) development. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. The process of formulating TMDLs is therefore a method by which impaired waters are identified and restoration solutions are developed and implemented to meet the goals of the Clean Water Act.

To address the water quality impairments identified in the EFLMR watershed, Clermont County, together with the other counties, villages and townships that comprise the East Fork Watershed Collaborative (the Collaborative), are taking the lead in developing a watershed-wide TMDL. This unique and innovative approach is the first such community-lead TMDL project in the state of Ohio, and is one of very few nationwide. Developing a locally-lead TMDL provides the Collaborative an opportunity to build upon ongoing activities, to ensure that local concerns are adequately addressed during TMDL development, and to possibly secure additional funding for protecting and improving water resources.

Two parallel and related approaches were used to better understand the reasons for biological impairment in the EFLMR watershed. The Stressor Identification approach utilized a weight-of-evidence process that considered the universe of potential stressors and evaluated the relative probability of each one to contribute to the observed biological impairment. Alternatively, a biostatistical modeling approach relied upon statistical evaluations of the relationships between available biological, physical, and chemical water quality data. One of the significant findings of this analysis was that meeting the biological criteria in currently impaired streams will be more dependent on addressing habitat factors, such as improving instream QHEI cover and pool scores, than reducing pollutant loadings. Flashiness (or the frequency and rapidity of short term changes in streamflow) was also found to be strongly correlated to fish scores and therefore the control of stormwater runoff should be a high priority in the watershed. Another interesting finding was that there is not a strong relationship between biological impairment and nutrient concentrations in the watershed, even though nutrients have long been considered one of the primary

reasons for non-attainment).

The finding that habitat and flashiness are among the most important variables in controlling biological health in the EFLMR poses some challenges with regard to TMDL development. This is because the U.S. EPA has made a determination that some categories of water quality impairment, including flow and habitat alterations, are best resolved through measures other than TMDLs. TMDLs instead are required to address impairments caused by discrete "pollutants," such as nutrients and sediment, which are thought be less important causes of impairment in the EFLRM watershed. A traditional TMDL developed for the EFLMR watershed would therefore focus on controlling pollutant loads when the Collaborative believes the focus should instead be on addressing flow and habitat problems in the watershed. This focus on pollutant loads would also translate into revised permit limits for the point sources in the watershed which, in turn, would require that resources that otherwise could be devoted to improving flow and habitat conditions would need to focus on reducing pollutant loads.

For these reasons, the Collaborative eventually decided to not pursue a locally-lead TMDL and will instead pursue a phased watershed management plan. Phase 1 will consist of implementing projects and programs that are already in development or have already been committed to. Additional nonpoint source controls will also be identified and implemented during Phase 1 that focus on the tributaries to the EFLMR and the primary headwater areas that have been found to be in non-attainment of their aquatic life uses. During Phase 1, preference will be given to tributary nonpoint source controls that improve stream habitat, decrease stream flashiness, and control the loadings of high priority pollutants. The Collaborative believes that many currently impaired streams can be brought into attainment as a result of Phase 1 activities.

During Phase 2, an enhanced level of controls will be focused on tributaries to the EFLMR where habitat and flow improvements have already been made but biological attainment has still not yet been achieved. Phase 2 nonpoint source controls will likely include those that control high priority pollutants (even ifthey do not also improve habitat or address flashiness). Water quality trading might also begin to take place during Phase 2 or a watershed-based permit might be finalized, depending on the decisions made in Phase 1. The final phase of implementation will be the adoption of all controls necessary to fully meet water quality standards, whether those are currently existing standards or new standards identified during Phase 2. Phase 3 has been set up to coincide with Ohio EPA's schedule to re-assess the EFLMR in 2012 and, if the watershed is still impaired, to develop an agency-lead TMDL by 2014. The overallschedule for the three phases are presented in Figure ES-1.

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